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AN EXPERIMENT IN TEACHING TOPOGRAPHICAL ORIENTATION AND SPATIAL ORGANIZATION TO CONGENITALLY BLIND CHILDREN.
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THIS RESEARCH ATTEMPTED TO ESTABLISH A BETTER UNDERSTANDING OF THE PROBLEMS OF CONGENITALLY TOTALLY BLIND CHILDREN AND TO TEST THE POSSIBILITY OF MEETING THESE PROBLEMS WITH A SPECIAL TRAINING PROGRAM IN GENERAL ORIENTATION AND SPACE PERCEPTION. A SAMPLE OF 60 CHILDREN WAS SELECTED FOR THE EXPERIMENT. THESE SUBJECTS WERE WITHOUT ADDITIONAL PHYSICAL HANDICAPS AND WERE BETWEEN THE AGES OF 5 AND 14. THOSE CHILDREN WHO WERE UNABLE TO EXPLORE AND INVESTIGATE ENVIRONMENTAL STIMULI IN A SPATIAL RELATIONS TEST AND THROUGH SUPERVISORY OBSERVATION WERE SELECTED FOR SPECIAL TRAINING IN AN EXPERIMENTAL GROUP. THOSE WHO WERE MORE OR LESS ADEQUATE IN THE TESTING AND PROVED TO BE DEVELOPING NORMALLY, WERE SELECTED FOR THE CONTROL GROUP WHERE NO SPECIAL TRAINING WAS TO BE GIVEN. THE EFFECTS OF THE TRAINING PROGRAM WERE MEASURED BY TESTS, OBSERVATIONS AND RATINGS. THE TOTAL SAMPLE WAS DIVIDED ALMOST IN HALF BETWEEN THE TWO GROUPS. THE FOLLOWING ASPECTS OF SPACE ORGANIZATION WERE SELECTED FOR THE EXPERIMENTAL GROUP--(1) AWARENESS OF POSTURAL CHANGES, (2) CONCEPT AND MANIPULATION OF EXTENDED SURFACES, AND (3) OBJECT PERCEPTION AND LANGUAGE. STATISTICALLY SIGNIFICANT GAINS OVER THE CONTROL GROUP WERE SHOWN BY THE EXPERIMENTAL GROUP AFTER THE TRAINING PROGRAM WAS COMPLETED. HOWEVER, THE LEVEL ATTAINED WAS NOT YET EQUAL TO THE MEAN ORIGINAL LEVEL OF THE CONTROL GROUP. FURTHER STUDY WAS RECOMMENDED TO DEVELOP A MORE EFFECTIVE APPROACH TO SPATIAL PERCEPTUAL PATTERNS. (JH)

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AN EXPERIMENT
IN TEACHING TOPOGRAPHICAL ORIENTATION AND SPATIAL ORGANIZATION TO CONGENITALLY BLIND CHILDREN

By

Ralph Garry and Anna Ascarelli

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CONTENTS

PROBLEM 1

HYPOTHESES AND OBJECTIVES 2

PROCEDURE 3

TRAINING PROGRAM 4

MEANING AND DEVELOPMENT OF SPATIAL ORGANIZATION 5

- Orientation 5
- Object Perception 11
- Language 20

METHOD OF TEACHING 22

- Phase one: Posture, position and fluidity of movements 23
- Phase two: Structuring extended space 24
- Phase three: Perception of objects 26
- Phase four: Language 29
- Lesson plans 34

THE SPATIAL RELATIONS PERFORMANCE TEST 40

- Spacial Vocabulary Test 46
- Comments on the test 48
- Attack Score 58
- Observations (form) 59

DATA GATHERED AND RESULTS 61

SUMMARY 66

FIGURES AND TABLES

Fig. 1. Two drawings of the Chapel by the same boy at a one year interval 9

Fig. 2. A "one perspective" interpretation of positional relationships 10

Fig. 3. Illustration of Tactual-Motor Sequences (1, 2, 3) and Spatial Sequences (4, 5, 6) 14

Fig. 4. Position of hand in grasping (A) from top, and (B) from bottom 15

Fig. 5. Illusion of Convexity produced by tactual approach utilized (grasping) 15

Fig. 6. Illustration of tactual approached making recognition of structure possible 16

Fig. 7. Two positions of body and arm in Sweeping Touch 17

Fig. 8A Reproduction of a triangle 18

Fig. 8B The drawn reproductions (2a, 2b) by two children, of the stick shown (1a) result from the Sweeping Grasping Touch illustrated (1b, 1c) 18

Fig. 9. Blocks 51

Fig.10. Board 51

Fig.11. Squares 52-53

Fig.12. Sticks 54-55

Fig.13. Disk Patterns 57

Fig.14. Relation of Gains and Losses on Attack Scores to improvement on the Spatial Relations Performance Test in Control and Experimental Groups. 65

Table 1 Chronological and Mental Ages of Control and Experimental Groups 62

Table 2 Pre- and Post-test Scores of Control and Experimental groups 63

Table 3 Differences between Pre- and Post- tests of Control and Experimental Groups and Net Difference between Groups. 63

PROBLEM

Retrolental fibroplasia has greatly increased the number of blind children of school age. This condition, which was first recognized in 1937 at the University of Chicago Clinics, is usually, although not exclusively, associated with prematurity - that is, with a birth weight of five pounds or less - and is known to be the effect of an excessive concentration of oxygen in incubators.

In a large percentage of cases retrolental fibroplasia results in total blindness which, taking into consideration the concomitant fact of prematurity, may be regarded as congenital, though in reality it did not exist at the time the baby was born. This group of congenitally totally blind children presents to parents and educators problems of greater complexity than children who have some residual vision or who have lost their sight later in life. At first a high incidence of mental retardation was suspected in this group of children who seemed to develop slower than expected, often exhibited a large number of mannerisms, and had difficulty keeping up educationally with their age group. It is tragic that many parents were told that their children were mentally retarded, as a more careful interpretation of the meaning of prematurity and a closer study of the mental ability of these children later disproved the diagnosis. This indicates, however, that the meaning of total blindness is still little known. This research represents an attempt to gain a better understanding of the problems of congenitally totally blind children and to test the possibility of meeting these problems with an especially designed training program.

Direct observations, interviews with teachers and school personnel in constant contact with children, and more objective data obtained through the administration of a Spatial Relation Performance Test to a group of about seventy totally blind children between the ages of 5 and 15 furnished the evidence that about fifty per cent of this group, regardless of chronological age or intelligence quotient, had difficulties which centered around the understanding and application of spatial concepts and resulted in poor orientation, lack of manipulative skills, and limited interest in the environment. It was also found that there were some perceptual and behavioral patterns that appeared frequently in this group at all age levels observed. It was possible then to formulate the broad outline of a program of training in spatial organization. A group of 30 children was selected and subdivided in 5 age groups to make possible further study of the development of spatial organization with age and eventually to evaluate results of training and adaptability of specific activities at the various levels..

The selection of the method of this research was based upon the following assumptions:

1. Perception is a conscious activity originating with the awareness of an environment of experience and ending in cognition.

2. Perception of self, orientation, object perception, and language are essential aspects of spatial organization.

3. It is possible to isolate patterns of spatial behavior which become characteristic of a child early in life and tend to endure.

4. Some of these patterns are perceptually more efficient than others.

5. A training program offers the possibility of continued observations on a group of children at various stages of development.

HYPOTHESES AND OBJECTIVES

1. It is possible, through group training, to direct or change the direction of the development of spatial perceptual patterns.

2. It is possible to develop a program of training in spatial organization, such that it may be used with children between 5 and 15 years of age by introducing variations in the order of presentation of lessons, the objectives and materials remaining basically unchanged.

3. The administration of such a training program may help our understanding of the meaning of total blindness and of spatial organization and of the relative importance of the various aspects of spatial organization to topographical orientation and perceptual learning.

4. It may be possible to evaluate the role of tactual and motor skills in the development of perceptual patterns, and to indicate specific teaching techniques.

5. This study may furnish criteria for the evaluation of commonly used didactic materials and for the selection of others.

6. This study may furnish data on the desirability of making available to preschool and school age children training in spatial organization as a developmental or remedial program.

PROCEDURE

Sample: The total sample included 70 congenitally totally blind children, between the ages of 5 and 14, inclusive, regularly enrolled at the Perkins School for the Blind, Watertwon, Massachusetts, and without evidence of additional physical handicap. Of this total sample 60 children were selected for the present study.

Controls: On the basis of testing and observations on the development of spatial perception done by these investigators at the time this study was planned, it was felt that the congenitally blind children could be divided into two groups: (1) Those children whose inability to explore or investigate environmental stimuli inhibits their spatial development; and (2) Those children who are more or less adequate in exploration. In all instances the first group shows inadequate "attack" procedures and restricted spatial development as determined by test, and observation reports by teachers and cottage supervisors. These deficiences do not appear to be associated with mental age, chronological age or sex. In this study group #1 was selected for special training. Group #2 (whose "attack" procedures are more or less adequate and spatial development apparently "normal") was not to receive training. Chronological age, sex, mental age were controlled by crude matching of the groups, but the essential controls were of two kinds: (1) Each child in the training group was to serve as his own control - improvement in spatial performance as judged by changes in pre-and post-testing, and by pre- and post-ratings by teachers and cottage supervisor on spatial orientation. (2) Comparison of performance between the two groups.

Experimental design: Sixty congenitally totally blind children between 5 and 14 were given a Spatial Relation Performance Test. Cottage supervisors' and teachers' ratings on the orientation and space perception of these children were obtained. On the bases of these ratings and test scores the total group was divided into two groups of good performers and poor performers, and the groups were roughly matched by chronological age. For the purpose of training, the poor-performer group was further divided into five groups of six children each and training was initiated with that phase of the program that seemed best suited to meet the specific common difficulty of the group. Unfortunately, it was not possible to select the groups on the basis of individual difficulties because of scheduling availability. Each group received a half-hour training daily for twelve weeks during the spring of 1958. The program was resumed in October, 1958 and carried out till May, 1959. During this second year, each group met twice a week for one hour periods. Three children of the original experimental group had left school and were not replaced. The same number of children, of corresponding age, was dropped from the control group. Upon termination of the training program, post-tests were administered to experimental and control groups, and new ratings were obtained from cottage supervisors and teachers. During the months of December and May of the second year each child was individually observed by a person not otherwise connected with this study, and rated on those aspects of behavior that seemed relevant to this research. The inquiry was intended to learn if the training program produced significant differences on an independent test of spatial relations, and if it produced transfer of training to spatial development and spatial orientation.

TRAINING PROGRAM

The following aspects of space organization were selected: perception of self, orientation, object perception, and language: accordingly, the phases of the training program centered around awareness of postural changes, concept and manipulation of extended surfaces, concept of three dimensional space, and meaningfulness of spatial vocabulary. For each phase, lessons were devoted to isolate specific experiences that would help children to gain an awareness of the genesis of the various perceptual aspects and of their contextual meaning. A brief outline of the phases of the training program will be given in terms of the concepts and skills each one purposed to test and develop while a description of the meaning and development of the aspects of spatial organization will serve as the theoretical orientation and justification of the related phases of the training program. It is necessary, however, to point out that both the spatial organization and the program were thought of as wholes and that the divisions mentioned were dictated by the experimental nature of this study and used here for clarity of exposition. In practice, the carrying out of the program required considerable overlapping of the various phases and integration of activities.

Phase one: Specifically concerned with teaching ways in which posture and body movement help in the determination of position of self and in establishing a point of reference for the location of other places, objects, or persons, and the importance of fluidity of movement in goal directed activity.

Phase two: A variety of approaches to the problem of structuring extended space, proceeding from surface to direction, perimeter and shape, encouraging comparison of temporal and spatial sequences and the formation of spatial patterns, the symbolic reduction of which is represented by topology. Space of locomotion was related to brachial space with reference to extension, direction, and shape. Specifically, the following relationships were stressed: position of the body and postural shifts, locomotion and direction of movement, termination of one directional movement and position, position and direction to localization and shape. Special attention was given to ways in which sounds structure space, by their nature giving information about the presence of particular objects and identifying places, and by their qualities indicating directions, openings, obstacles, and distances. The identification of the source of contemporary sounds creates acoustic shapes by fusing direction and distance. These first two phases broadly correspond to those aspects of spatial organization that constitute orientation, both as organized body space and topographical representation.

Phase three: Specifically concerned with three dimensional space and the perception of objects. Starting with the identification of the position of lines and planes as absolute and relative to other lines and planes, building concepts of straightness, horizontality, perpendicularity, parallelism, etc., then proceeding to the exploration of objects showing how these concepts are used to arrive at the cognition of form and structure. Emphasis was placed on the modality of touch, on tactual illusions, and on specific motor and sensory skills. Perceptual characteristics were analyzed in terms of their relevancy to the identification of objects, stressing the fact that the temporal order in which they are uncovered or the motor sequence representing them do not correspond to the value they have in terms of the form structure and meaning of the object. Reduction of motor-tactual sensations to spatial representations, and abstractive synthesis were encouraged by stressing the intention to form images and by schematic two- and three-dimensional reproductions.

Phase four: The main purpose of this phase was to show how the organization of space may be expressed and communicated symbolically, through gestures, postural attitudes, sounds, designs, plastic representations, mimicry, and language. Careful attention was given to the relationship of language to experience, stressing the need for accuracy and specificity of description for the clear understanding of the meaning of words and of their symbolic value.

MEANING AND DEVELOPMENT OF SPATIAL ORGANIZATION

Orientation

Definitions:

Orientation is a process by which directions are ascertained and the position of the self, buildings and other objects localized in terms of the points of the compass or some other general reference. Thus defined orientation implies the concepts of position, localization, direction and distance. In the experience of the blind child orientation originates with awareness of body position as static, of postural changes as they accompany movement, and of the motor-muscular sensations of locomotion. The formation of concepts of location, direction and distance is based on the conscious translation of these bodily feelings into spatial atemporal relationships through the progressive reduction of the subjective involvement and the creation of a world of objects, the position of which signifies the structure of that space that the experience of movement posits as empty space. The meaning of this reduction will become clearer as we proceed to analyze these concepts and attempt to trace the genesis and development of their motor and perceptual elements.

Position: The concept of position combines in an abstractive synthesis the perception of the body as a whole, that is, of the body as a limited physical object, capable of assuming, maintaining, and changing posture, and the perception of the posture of the body in relation to one or more points of reference outside of the body, such as floor, walls, etc. Position thus refers to the orientation of the body at each moment with reference to its axis and to one or more other planes. In this sense the most common positions are vertical and horizontal, implying relationships of parallel and perpendicular.

Location: The concept of location is not based on postural perceptions but views the position of the body in relation to the position of other objects in a spatial continuum, usually represented by an extended continuous surface. The concept of location requires the ability to imagine the position of self and of other objects as existing and enduring.

Direction: Direction is the ordering of locations according to a general rule, such as the compass points. This concept of direction is quite remote from actual experience, especially that of the blind child who can perceive only one location at a time - his own - and this by referring his position to that of another object within his brachial space.

Distance: Linear space between locations. In experience, distance is movement through time.

Perceptual aspects of Orientation:

Through tactual activity a baby experiences his body as an object. As sensations become more specific and as he learns to localize them and to control movements, he becomes aware of the limits of his body and of his belonging to it. From then on the body is the subject of the experience of a reality that unfolds as an increasing range and specificity of sensations. The child is the object of his own experiencing physicality till he becomes aware of being a self other than his body and consciously assumes his body as a mode of appearance in the world and consciousness as his subjectivity. He can now objectify reality as it emerges at each new physical encounter of his body with something other than itself and translate the sensory impact of experience in perceptual relationships of meaning.

The body: posture, position, and location. The ability to maintain awareness of the self as separate from the body is basic to all aspects of the spatial organization of the blind child since he experiences his environment tactually and motorially, and the physical world as such ceases to exist altogether the moment his tactual-motor activity ceases, unless he can spatialize his sensations. Translation of tactual-motor sensations in perceptual-spatial representations requires the understanding of the spatiality of the body and of the meaning of movement referred to it as to a spatial object, that is, externalized and indifferent to body sensations. Orientation, as well as object perception, is based upon awareness of body position - which is awareness of the spatial relationships of parts of the body to its axes, and of the body as a whole to other bodies. When completely abstracted from postural and motor feelings, and conceived as objectively enduring, position comes to signify location.

Motion and locomotion: Extension, direction, and distance. The development of the understanding of the spatial dimensions of the body leads to the understanding of position and location as the place actually or imaginatively occupied by the body and other objects. Awareness of the body qua spatial object, when related to locomotion, makes possible the understanding of extensionality, direction, and distance. It is possible to attempt a description of the development of these understandings which, without pretending to be exact, still may be useful in suggesting activities and method of teaching.

The experience of creeping may be important to the development of orientation and spacial organization, as it affords the child a perception of self as the center of a bounded space which, because of his position, he can completely appropriate. Provided sufficient and repeated stimulation to locomotion and a limited and constant environment, creeping may represent the experience of the continuity of a level surface, of the endurance of locations, and of the solidity of barriers. It is possible, however, that the blind child does not perceive the floor as such because of the homogeneity and internality of his tactual-motor experience of it while creeping. He may perceive the boundaries of this creeping space as something other than himself because they represent the sudden imposition of a barrier to locomotion. The same barriers, as the child learns to stand up and begins to walk, may become assimilated within the body limits of the child as he uses them for support, frontally bracing them with both hands and pulling towards himself.

Moving from place to place the blind child is first of all aware of his own movements. The first vague meaning that "direction" acquires is derived from the awareness of postural changes as shown by the fact that blind children often explain the meaning of the word "direction" by referring to the sensations experienced in a car making a sudden or sharp turn - and this may be unfortunate because what is experienced is a gravitational pull in the direction opposite to the turn of the car. An association of right and left turn with this sensation, which is quite likely to occur, is not a serviceable one for the child at this stage, in fact, it may be a faulty one in terms of the meaning of "right" and "left". A sensation somewhat similar is that experienced in rapid twirling the body but here again, if the association of right and left is extended, it refers to a direction of motion or postural shift and not locomotion. Many blind children do not seem to spontaneously notice changes in direction while walking or being led or guided by someone, perhaps because these changes are too gradual to result in definite sensations, or perhaps because often a child led by the hand is not walking frontally but somewhat sideways and turns actually are experienced as variations in acceleration or deceleration. Gait and rhythm obviously play a part in determining the quality and quantity of perceptual discriminations possible.

When the child learns to turn right and left as different from gyrating and to evaluate the degree of the rotation needed - which is difficult in the absence of visual feed-back - direction acquires the meaning of a difference in body orientation but still refers to a movement at a fixed location. When right and left turns are followed by, and consciously referred to, locomotion direction is projected in space and becomes direction of movement, and at the same time movement is recognized as change in location.

The next problem is that of maintaining the direction of movement, and here the blind child has to cope with the complications presented by spontaneous veering. Veering, of course, is not peculiar to the blind child, but in the absence of the continuous correction that vision normally provides, the veering of the blind results in a directional error, the magnitude of which is a function of the strength of the tendency to veer, the distance, the time employed in covering the distance, the balance of the child, and, naturally, the nature of the terrain. The time element could be termed rate of walking more properly than speed. Regardless of the degree of veering, the child does not appear to be aware of the actual magnitude of the resulting error. Sidedness may influence veering and remain a motor constant so closely integrated with the experience of walking that cannot be spontaneously isolated. When the child is being led and the veer is controlled, the observable result is often a noticeable pattern of body weight shift, or a difference in the lenght of the steps (right and left) or in the force (stamping) of the steps. To some extent the feeling of the upright is influenced by the same factors. Though it may be assumed that the factors influencing veering are constants, many blind children learn to use auditory cues to correct it, and many others can be taught to control veering or to correct the error. Only in the case of control of veering it is possible to speak of direction of motion, however, the intentionality of direction operating in this case is the same as that allowing a correction of a veer error. In terms of the relationship of direction to distance and location, to control veer, depending on how habitual it is, may be equivalent to no veer while to correct the error results in a changed relationship by introducing an intermediate location that must be recognized as such, and therefore intentionally discarded, qua location, while being provisionally retained as body position. Veer error correction should become automatic before direction can become a step towards orientation. In this case the error position would not represent an intermediate location - in fact it would not be differentiated from any other moment of the temporal-kinesthetic experience, nor would the latter have to be emphasized during the beginning stage of the process of orientation, which, for its completion, requires the negation of this very experience.

So far two meanings of the word direction have been considered, namely: positional orientation of the body, and direction of movement of the body. These two meanings are directly experienced by the child who can move freely, as they are based on motor-kinesthetic sensations and on the appreciation of the extent of the space of movement. At this stage, the child has achieved a level of orientation which may be termed subjective. He is capable of orienting himself with regard to a source of sound: he can turn towards it and walk to it, provided he can localize it accurately. He may also be capable of memorizing his way from one place to another by the use of auditory and temporal-muscular cues. This does not represent topographical orientation which is the ordering of locations according to an objective rule, as previously defined. To achieve topographical orientation the child must learn to interpret his sensations in terms of space, of objects, and of enduring locations. Here, direction acquires a third meaning: the relative orientation of two or more locations. Before this meaning may be realized, the child must understand location as movement from and towards a location or, in other words, view his activity as space between locations, or distance in a determined direction. As far as his concept of space is concerned it must change from space of movement - and therefore empty space - to space as container of objects, characterized by extent, direction, and distance. His concept initially acquired with reference to body position must extend to include a multiplicity of objective relationships. In the absence of sight there is no direct experience of this container space or of location in itself: they can only be understood through a process of perceptual abstraction by which motor-kinetic sensations are spatialized and objectified. It is possible for a blind child to form a mental image of the spatial relations existing between locations, provided sufficient experience coupled with a conscious intent towards spatial synthesis.

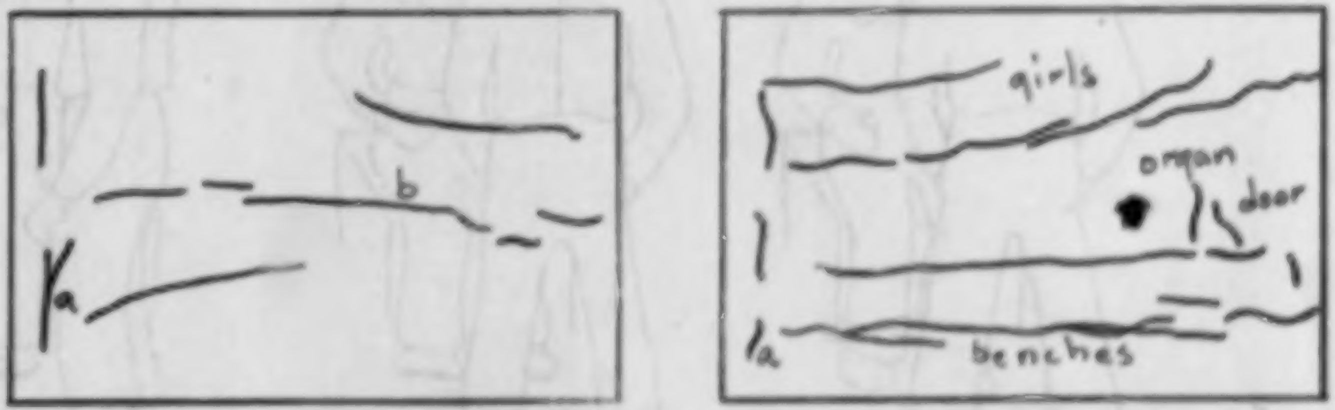
At the same time sounds and smells acquire a distinctiveness and specificity that develops in sign and symbol meanings and schema. Sound is now known to be the source of obstacle perception. Direction of sound, echoes, resonances, differences in air pressure and temperature, perceived in relation to objective space, represent volumes, differentiate open from closed-in areas, give clues to the structure of buildings and may come to signify architectural details and styles. Thus the child experiences the three dimensions of distant space.

A few concluding remarks may qualify, and perhaps clarify, the outlined development of those understandings that appear essential to topographical orientation. The order followed was derived from the order of development of the underlying motor skills and it was selected because it points out that in orientation the first and essential object of perception is the body, then comes space. This is an important point that must be taken into account in teaching orientation and object perception. The child does not experience space as such, or position, location, direction or distance as belonging to space: he experiences skin and muscular sensations which have an immediate meaning of position, postural changes, and motor activity In the absence of specific stimulation the totally blind child would probably not walk, but rock or jump up and down or violently shake arms and legs in an almost spastic pattern. He must learn to walk and move freely, and he must be aware that his motor activity is goal directed before he can learn to perceive space, even the phenomenological space of concrete relationships.

Objective space is a perceptual abstraction: it represents the symbolic referent of spatialized motor activity - actual and possible - and therefore atemporal.

We have here an illustration of three perceptual levels. The first level is consciousness of one's own body as a physical entity, static and dynamic, and of illimited empty space, vaguely quantified by the temporality of movements. The second level is consciousness of relatedness of self and object, or particular space. This space is personal, structured by the particular perspective of the immediate situation. The third level is self-consciousness of the relationship of the self qua spatial object and space, looked at from the outside from a self-subject. This level allows for a multiplicity of perspectives and results in a public space objectively structured. The immediate situation is only an accidental one among the many possible ones. At the first perceptual level the self is the creator and controller of an event; at the second level it has a role similar to one of the terms of a comparison; and at the third level, it is equivalent to the tertium comparationis (i.e., the essence of the comparison).

As a concrete illustration, one may think of a child trying to decide which is the right hand of a person facing him - or, for that matter, of any adult looking at a map in a strange city. It may be pointed out that, at the first perceptual level, the child relates himself to the environment only emotionally. His space is empty and private, completely exhausted by the duration of his activity. All that can be said about private space is that it "exists" as awareness of freedom and control of movements, of moving air, or of sounds. Its center can be localized in the skin surface or in the body but there are no boundaries to this existential space. Objects are not part of it because any encounter constitutes a barrier to freedom of movement and, therefore, an end to that duration of time through which space existed. The centrality of the self in this perceptual event is reproduced verbally by the expression that refers to it, "here I am". Existence and presence are synthesized in one moment of consciousness. "Here", in this case, is the locus standi of the percipient at one particular time and it has meaning only with reference to this occasion of being or, in other words, it is the standpoint from which the self views himself. No outside relationship is implied. The perceptual space of the second perceptual level, on the contrary, admits of another meaning for "here", that is, "not there". It identifies a perspective and a spatial continuum including two or more simoultaneous events.



Chapel 1

Chapel 2

Fig. 1. Two drawings of chapel by the same boy at a one-year interval.

These two drawings, made by the same boy at the distance of one year, represent the school Chapel. The first one was accompanied by the comment: "This is the way I go in every morning. Here is where I sit (line "a"). This is the way the speaker comes in (line "b")." At this time, the boy was unable to name or locate anything else in the chapel. During the second drawing, the various elements were named as indicated. The motor perceptual aspect characteristic of the first drawing is still noticeable in the second one, in the lines at the lower left corner leading from the entrance to the place this boy occupies, but the drawing as a whole seems to indicate a higher perceptual level. Space is still subjective, not bound by walls, but somewhat unified by the relationship of spatialized and localized motor and auditory experiences. It is of interest that the same lines at the lower left were also described as "benches" this time. This may be interpreted also as indicating a greater awareness of the meaning of tactual sensations since the direction of the lines approximates the direction of movement (of the body and therefore of the hand touching the benches possibly as a guide), rather than the position of the benches. One gets the impression that this boy is actually saying: "Let's go in and sit down and then listen to find out what is where." The first drawing is centered around the self, the second one is oriented by one perspective and organized as a temporal sequence.

The meaning of "one perspective" can be more clearly exemplified by isolated relationships, eliminating the temporal element. The following illustration (Fig. 2) shows how a child interprets a request to stand in front of, in back of, and beside another child (seated).

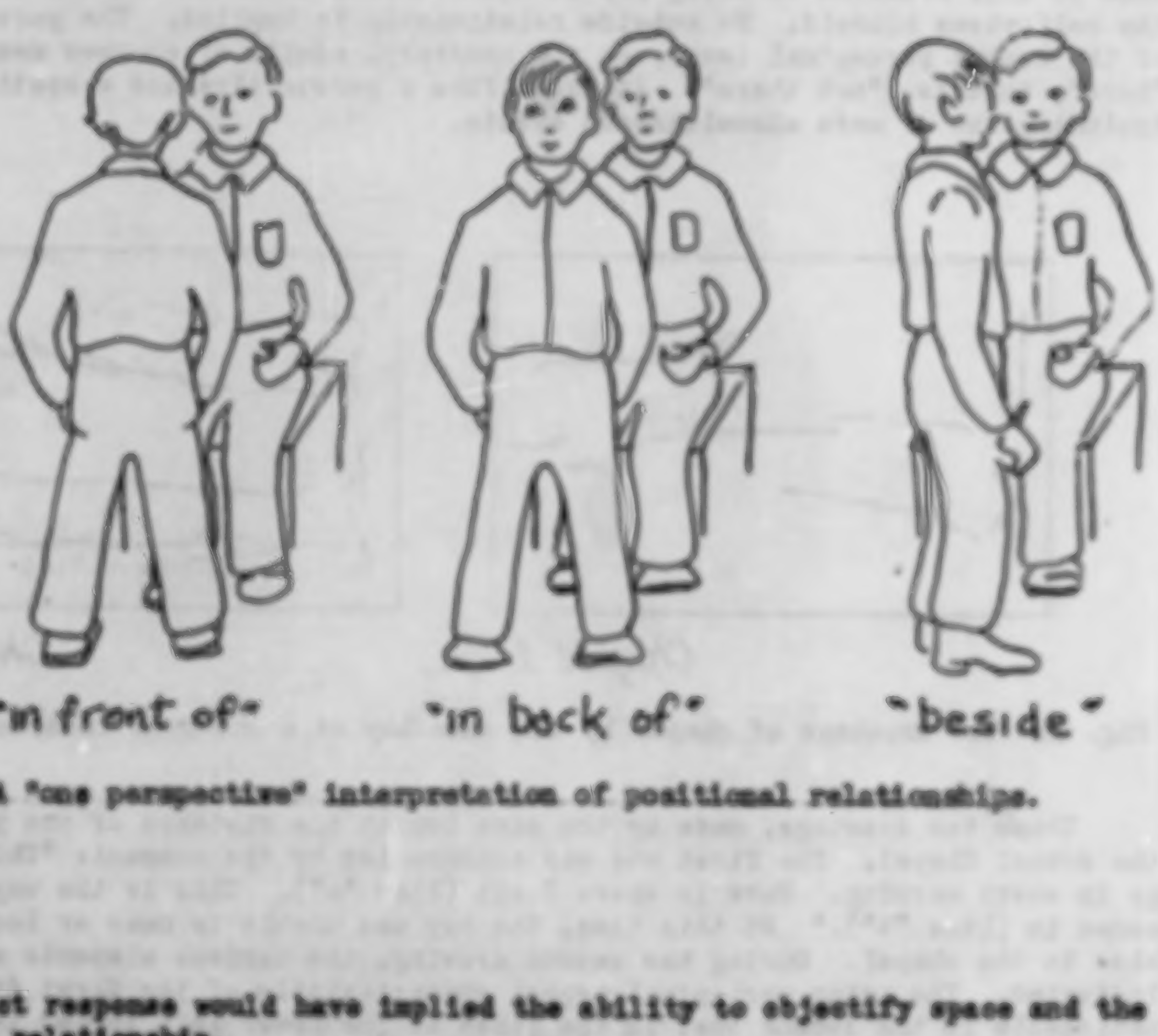


Fig. 2. A "one perspective" interpretation of positional relationships.

Correct response would have implied the ability to objectify space and the self-other relationship.

Object Perception

General Considerations:

To the distinction between subjective and objective space made in discussing orientation correspond the distinctions between obstacles and objects, and the more traditional one between the appearances of an object and the object-in-itself.

As soon as the blind child starts moving about, he encounters obstacles. They represent barriers to movement and are experienced as ways of bumping, particular localizations of a more or less sharp pain sensation. With the gradual development of orientation, he learns to identify them as locations, "things" on the way, and, finally, objects which may be wholly or in part investigated tactually. So the world of objects emerges at first undifferentiated, slowly becomes organized in motor-spatial syntheses, and finally is broken down in the individual spatiality of objects. "Object Perception" usually refers to this last stage but it presupposes the others, both in terms of the meaning of "object" and of "perception".

The distinction between obstacles and objects persists in the life of the blind person as the choice between two perceptual attitudes: in one, an object is a barrier in space and in the other, an object is a spatial entity that may have meaning in itself in relation to the self, in relation to a particular experiential occasion, or as a symbol.

Perception as a conscious activity implies awareness and goal directedness (intention), and includes physical, emotional, and rational elements. Particularly with the blind, perception, to be cognitive, need to be conscious activity. Visually an object appears situated in an environment of objects and therefore immediately defined in at least part of its physical limits and positional orientation. This represents an external frame of reference to further visual and/or tactual exploration and the motor activity that accompanies it appears to consciousness as the structural spatiality of the object, immediately negated as motor activity. In the absence of sight, instead, an object appears as the subjective experience of skin and muscular sensations. Perception must negate its essential subjectivity in order to establish the external nature of the object. Qualities are then intentionally perceived on the object and progressively sinthesized. This synthesis requires an impoverishment of the original sensations, a reduction of cues, as non-essential characteristics are eliminated and a simplified structure emerges which, in turn, is the basis for further reductions as structures are generalized into schemes and original elements acquire the simplicity of symbols.

The difficulty some blind children have in perceiving and ordering the space of objects, if not derived from structural peculiarities of the object, may be sought in the tactual motor activity of the perceptual process that reproduces the structural unity of the object. Order is, physically, the pattern of movements performed in investigating an object and the rule by which the data of this investigation are used. An object enters the experience of a blind child through a sudden contact which might be pleasant or unpleasant, and may be interpreted as a barrier to movement; in any case it has an affective value which must be isolated and negated to posit the non-subjective physicality of the object and make possible the interpretation of sensory data and motor activity in terms of textural, formal and structural characteristics envisioned on the object while taking into account the relationship between the pattern of tactual sensations and the motor pattern. This relationship is important because the tactual sensations are a function of a motor pattern felt internally but structured by the spatial characteristics of the object: it is through the realisation of the externally determined direction of movement that the tactual data can be interpreted as qualities or quantities attributed to the object.

In discussing orientation it was observed that veering errors must be corrected prior to using direction to develop orientation. Observations of the same order may be made with regard to the movement of hands, arms, and body that accompanies the perception of objects, for in this case, also, position direction and distance are the elements of the reproduction of a spatial structure: the object. Like orientation, object perception requires that the self be kept separate from its activity, continually, during the exploration. Like orientation, object perception requires the establishment of locations and the identification and memory of the relationships involving these locations. Again, like orientation, object perception results in an organised representation through the abstractive reduction of sensory motor impressions.

The Object:

Objects have characteristics that may help or hinder tactual perception. The first characteristics to appear are those of temperature, texture, and density. Any sudden passive contact with an object gives these first impressions which, because of their affective value, are important in determining the attitude the child assumes towards furthering investigation. The strength of these, or of any of these impressions may also determine the direction of the investigation: for instance, a tactually striking, pleasant texture may become the focus of attention in examining an object where textural changes are involved, at the expenses of other sensations with greater descriptive value. Skin sensations remain dominant over temporal-motor ones and the object unfolds as a sequence of textural changes of varied quality whereas if, going beyond these first impressions, the object is examined with the intent of identification skin impressions become subordinated to and integrated with the spatial pattern emerging from the temporal kinesthetic sensations. Decorations, uniformity of materials, homogeneity of surfaces, compactness, and size are the characteristics of an object to acquire relevance next, and each one of them may, again, operate in determining the course and focus of further investigation. None of the characteristics so far mentioned gives information sufficient to the identification of the object, which depends on an analysis of the structure of the object. The complexity of this structure may vary greatly with regard to the number of elements it contains, with regard to the relationships existing between these elements, and, finally, with regard to the texture, shape, and size similarities of the various parts and of the parts with reference to the whole.

According to this order of presentation of qualities, an object is defined first as a surface, then this surface is broken down into a number of surfaces which are later defined into shapes and placed in that particular relationship of position that represents the form of the object. Implicit in this process is the shift from a two-dimensional to a three-dimensional space, from shape and area to volume and form. This shift does not necessarily appear at the end of the inspection - in fact it is to be regarded, and such it appears to be when tactual observation is efficiently conducted, as an underlying duality of perspective that makes possible the interpretation of two-dimensional data in terms of a three-dimensional space, so that the symmetry of the top of a wooden box may suggest an expectation of the equivalent symmetry of the bottom of the same box. The maintenance of this dual perspective depends in part on the size, structural complexity and integrity of the object, and in part on the approach of the child to the object. An analogy might be made, that the blind person, in formulating a percept of form and volume, is faced with a task similar to a sighted person's view of a blueprint which requires him to synthesise three two-dimensional perspectives (views) into a single three-dimensional perception.

Considering all the variations possible in each of the characteristics mentioned, it is evident that some objects may be perceived tactually much more easily than others; and it is possible to conceive of objects of such a tactual complexity that perception is impossible. Range and amount of experience play an obvious role in facilitating tactual exploration, and it was already pointed out how object perception is dependent upon orientation, both with regard to physical activity and to the formation of basic spatial concepts but there are other individual factors that need consideration.

Posture and Position:

The space of objects is filled space in two ways: one, an object fills the space it occupies; the other, establishing tactual contact with an object fills the space between the subject and the object by incorporating the object in the physical framework of the body and by giving meaning of concrete spatiality to the movement that terminates with the contact. This corresponds to the effect produced by the eye movement in looking at a design composed by a curved or diagonal line and a dot to the right of it: The space to the left of the line is discarded, and that between the line and the dot becomes an integral part of the design as if structurally belonging to it. Modern art can furnish some good illustrations of the use of this effect in abstract compositions.

When a blind child comes in contact with an object he becomes aware of a physical spatiality that extends the limits of his body to comprehend the object. So the object is first of all realized as an internal presence. The position of the body in this case is perceived passively and regardless of body limits, for the body is localized by those same sensations that localize the object. Reflection and preprioceptive sensations of postural change will re-establish the integrity of the body and the physical independence of the object, while changes in position will give cues to the orientation of the object in relation to the self by introducing variations in perspective. Posture is relevant to object perception also because it determines to a great extent the range, freedom, and coordination of movement of the arms and hands.

The hands:

The position of the arms and hands during tactual exploration has somewhat the same implications with reference to the parts of the object that the position of the body has to the whole. The hand that maintains a static contact with an object uncovers nothing about it for even the skin sensation of contact tends to disappear in a short time. Outward rotation of forearm and wrist (extraversion) affects perception, as it is accompanied by an exagerated outward extension of the elbows that can hardly be taken into account in the interpretation of motor patterns and that results in fore-shortened perspectives and in the curvature of straight lines and surfaces, even of limited extension and even if well within the brachial space of the child. This position of the wrist, as well as that determined by inward rotation (introversion), modifies and limits the range of movement of the thumb and therefore its usefulness in estimating sizes.

The use of both hands simultaneously in opposition and in alternate positions establishes relationships of location of parts, corrects directional errors originating from slant in reaching, and defines areas and volumes. Exploration conducted with only one hand, or with either hand subsequently results in a temporal pattern or in a spatial sequence. A temporal pattern is a tactual-motor sequence which may represent the absolute position - but not the spatial interrelation, of several elements in a time sequence order. A spatial sequence disregards the orientation of the parts and of the whole, and only maintains the relationship of contiguity between single aspects as the order of representation, thus failing to achieve a synthetic unity.

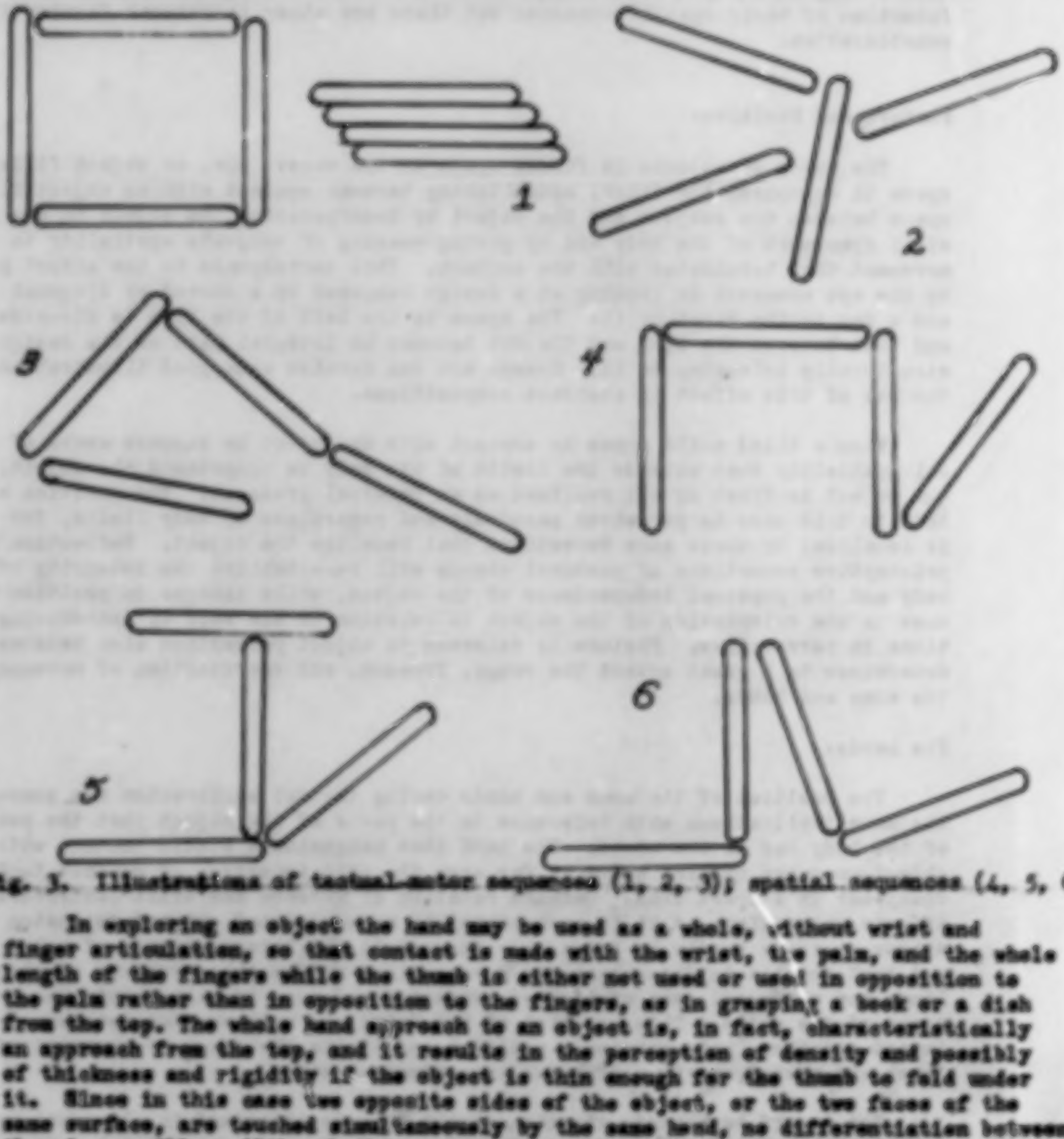


Fig. 3. Illustrations of tactual-motor sequences (1, 2, 3); spatial sequences (4, 5, 6

In exploring an object the hand may be used as a whole, without wrist and finger articulation, so that contact is made with the wrist, the palm, and the whole length of the fingers while the thumb is either not used or used in opposition to the palm rather than in opposition to the fingers, as in grasping a book or a dish from the top. The whole hand approach to an object is, in fact, characteristically an approach from the top, and it results in the perception of density and possibly of thickness and rigidity if the object is thin enough for the thumb to fold under it. Since in this case two opposite sides of the object, or the two faces of the same surface, are touched simultaneously by the same hand, no differentiation between them is possible. Although this approach is from the top, it does not furnish sufficient elements to suggest the height of the object because the downward movement of the arm and hand is ideally completed and referred to the axis of the body. Height, length, width, extension and volume are signified by combining the relationship of distance and position of the hands throughout the exploration of the object.

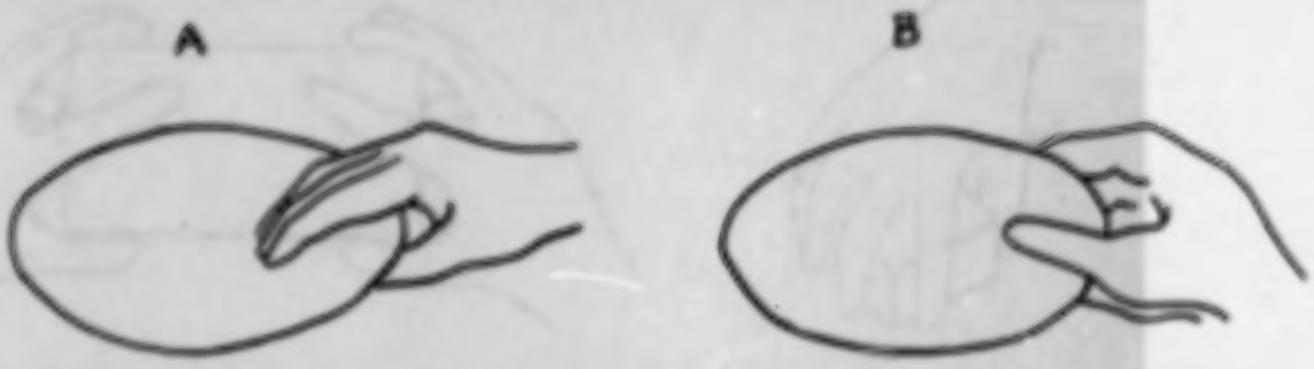


Fig. 4. Position of hand in grasping (A) from top and (B) from underneath.

When the hand is used as a whole and the surface touched fits the size of the palm so that the fingers can fold down, as shown in Fig. 5, the slight arching of the hand that accompanies the folding of the fingers produces what may be considered a tactual illusion of convexity.

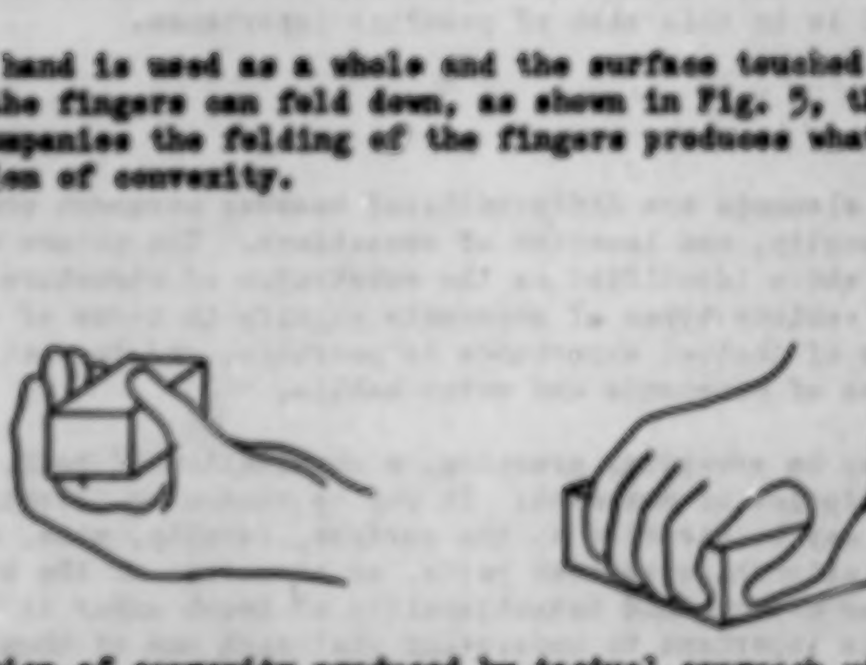


Fig. 5. Illusion of convexity produced by tactual approach utilized (grasping).

Articulation of the wrist and of the fingers allows the hand a variety of positions that facilitates the exploration of objects. The efficiency of the various positions is relative to the characteristics of the object and cannot be discussed in abstracts however it is important to note that the independence of movement of fingers and thumb within the natural relatedness immediately existing between the five positions at each moment attained (finger tips and thumb) offers the possibility of structured synthetic prehensions. Figure 6 illustrates this position.

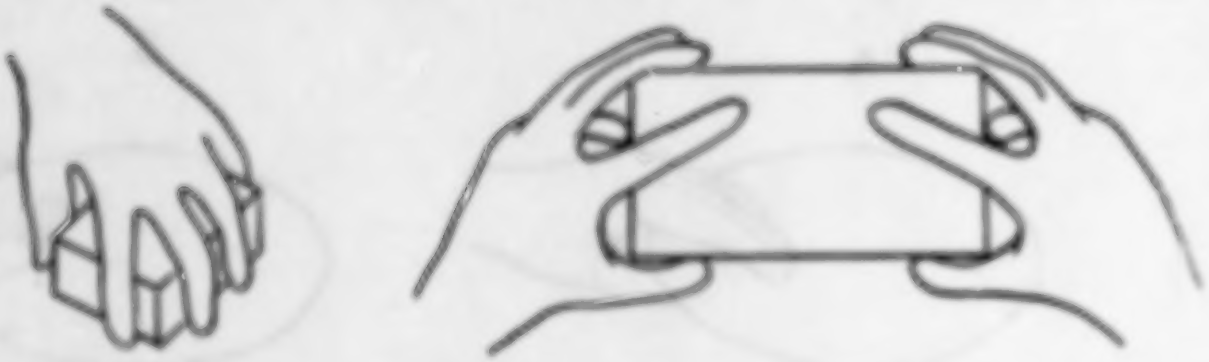


Fig. 6. Illustrations of tactual approaches making recognition of structure possible.

Similarly, some small objects may be immediately recognizable to what may at first appear as static touch when the hand completely envelopes the object, provided that synchronous impressions are spacially differentiated and localized. The shape of the object is in this case of peculiar importance.

Touch:

Tactual elements are differentiated because movement provides change in the quality, intensity, and location of sensations. The nature and function of motor patterns was above identified as the substratum of structure. It is relevant now to examine what various types of movements signify in terms of sensory experience, that is, what type of tactual experience is possible, and to what extent, in relation to specific types of movements and motor habits.

Touch may be sweeping, grasping, a combination of both, structuring or metric, from the standpoint of movement. It may be random or intentional, and even when intentional, may be directed at the surface, density, size, direction, shape, proportions, relationships between parts, or structure of the object. It is possible that all these aspects and intentionality of touch enter in the perception of an object. It is important to understand what each one of them can contribute, and possibly how, in the absence of the others for this may help us to clarify the meaning of the tactual appearances of an object to a blind child.

Sweeping touch: The fingers or the hand move over a surface or a line with a minimum of pressure: this movement may start at the elbow or at the shoulder and in either case it implies rigidity of the wrist and a broad circularity of motion. This touch gives an impression of the homogeneity of the surface, more or less limited, depending on whether the whole hand or only the finger tips were used. Some children use only the index finger, usually of the right hand - commonly the motor hand - while holding the other fingers up with the wrist somewhat extraverted. This position can be often observed in children reading braille and may be due to the fact that the area of greater sensitivity in their index finger is located towards the left side rather than in the middle of the pad. Since this position of the hand does not offer any other contact with the page that could be used as a guide for following a line or dropping to the next, uniform direction is maintained by a postural adjustment whereby the body is twisted at the waist towards the left and often supported by the left arm on the table, while the book is slanted upwards to the right. The movement of the right arm starts at the shoulder with elbow and wrist held at a constant angle and the finger moves straight across the page. If this movement were extended it would result in a movement of the trunk, rather than in the extension of the arm, thus maintaining linearity. If the angle of the elbow changed, as it occurs when the arm is held close to the body, the resulting movement of the hand would be rotatory and this would increase the difficulty of following a line (convexity effect), and would necessitate the use of the other hand to help locate the next line. This approach to Braille does not necessarily imply poor reading skills although it has its number of poor readers. It might be noticed however that for the beginning reader, and for the poor reader who may have difficulty in recognizing dot formations of single cells, this approach results in additional movements back and forth across the cell (when the pad of the finger is used the movements tend to be rotatory) so that the pattern of dots is each time reversed and understanding is not made easier. In this case the difference between a rotatory and a back-and-forth movement is made more significant because it is related to pressure changes. Further study of this area would be justified for the implications this position has for body posture and for tactual efficiency. In this connection some thought should also be given to the format of braille books and to the criteria underlying the spatial organization of the page, especially in pre-primers and primers.

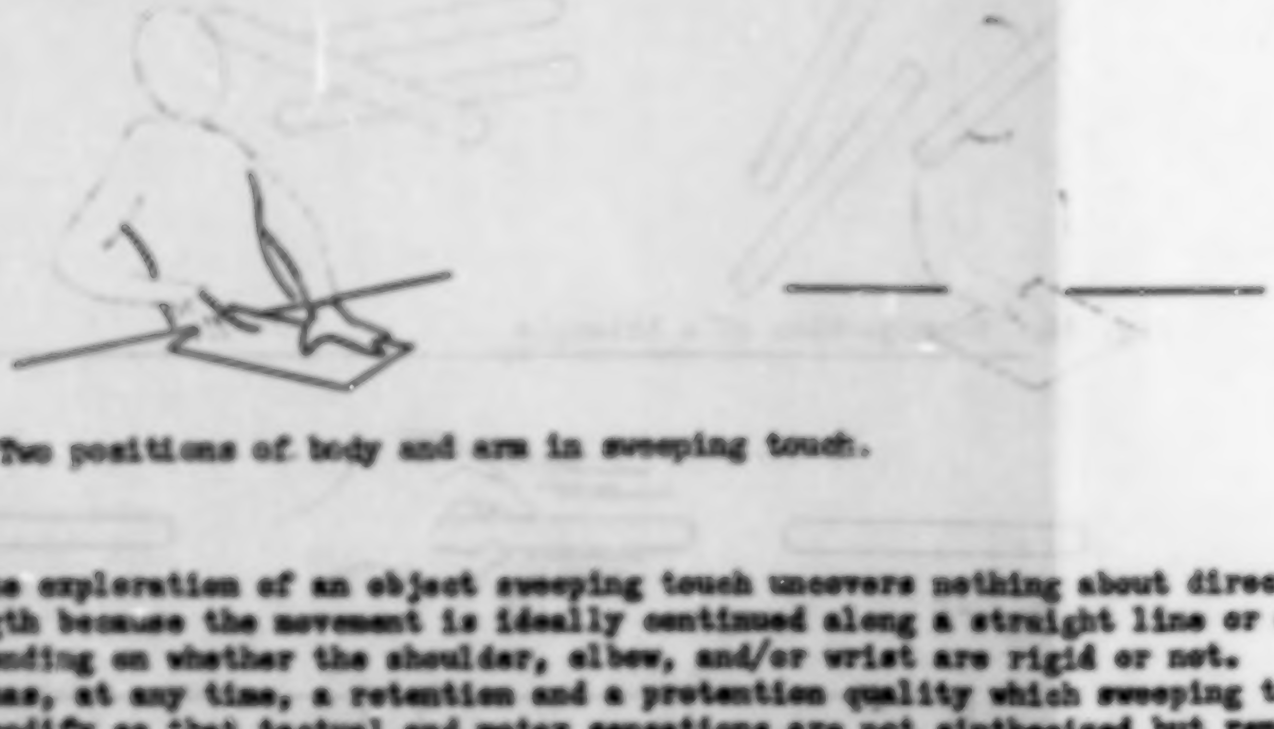


Fig. 7. Two positions of body and arm in sweeping touch.

In the exploration of an object sweeping touch uncovers nothing about directionality or length because the movement is ideally continued along a straight line or a curve depending on whether the shoulder, elbow, and/or wrist are rigid or not. Movement has, at any time, a retention and a protention quality which sweeping touch does not modify so that tactual and motor sensations are not sinthesized but remain in turn affective and kinesthetic (lacking, that is, representational value). The blind child however will interpret his sensations as qualities of the object, and describe it as smooth, hard, flat or bumpy, round or straight. The amount and consistency of pressure used in sweeping touch may produce an inference of flatness. Sweeping movements are often from side to side but occasionally a child shows a definite preference for movements towards and away from self, or from top to bottom. This fact does not change the results of sweeping touch but points to a definite directional orientation to the vertical which is accompanied by lack of understanding of the concept of perpendicular. Similarly, a child may be oriented exclusively to the horizontal. It is doubtful that this may be a result of poor wrist articulation, though this is a concomitant finding. Body and object orientation is made impossible by this one-dimensional behavior. In the light of the preceeding discussion on orientation, it is reasonable to suggest that limitations in motor activity in early life may account for later uni-directionality.

Grasping touch: Fingers and thumb, in opposition, follow the outline or surface peculiarities of the object or, when this is sufficiently small, fold completely around it, passing from grasping to enveloping touch. Grasping touch may accompany sweeping movements and represent dimensions of length and possibly extension of surface. In this case, the larger, sweeping movement is terminated when the fingers, in reaching the end of the surface or object, fold upon themselves. The movement and the termination however do not become synthesized and are represented as separate elements. This is an effect similar to that produced for vision by an angle topping a line and, in a way, the similarity goes farther because the closing of the fingers gives the tactual illusion of an angle, or, in the language of the child, a point. Lack of synthesis in this case may be due to the different origin of sensations represented as line and point with the predominance of tactual elements in one case and motor elements in the other. Figure 8 is a reproduction of drawings (line and stick designs) made by children and meant to represent triangles, (8A), and a flat stick with rounded ends. It is included to illustrate the meaning of grasping and sweeping-grasping touch, and to suggest differences in the representational value of extereceptive and proprioceptive tactual sensations.

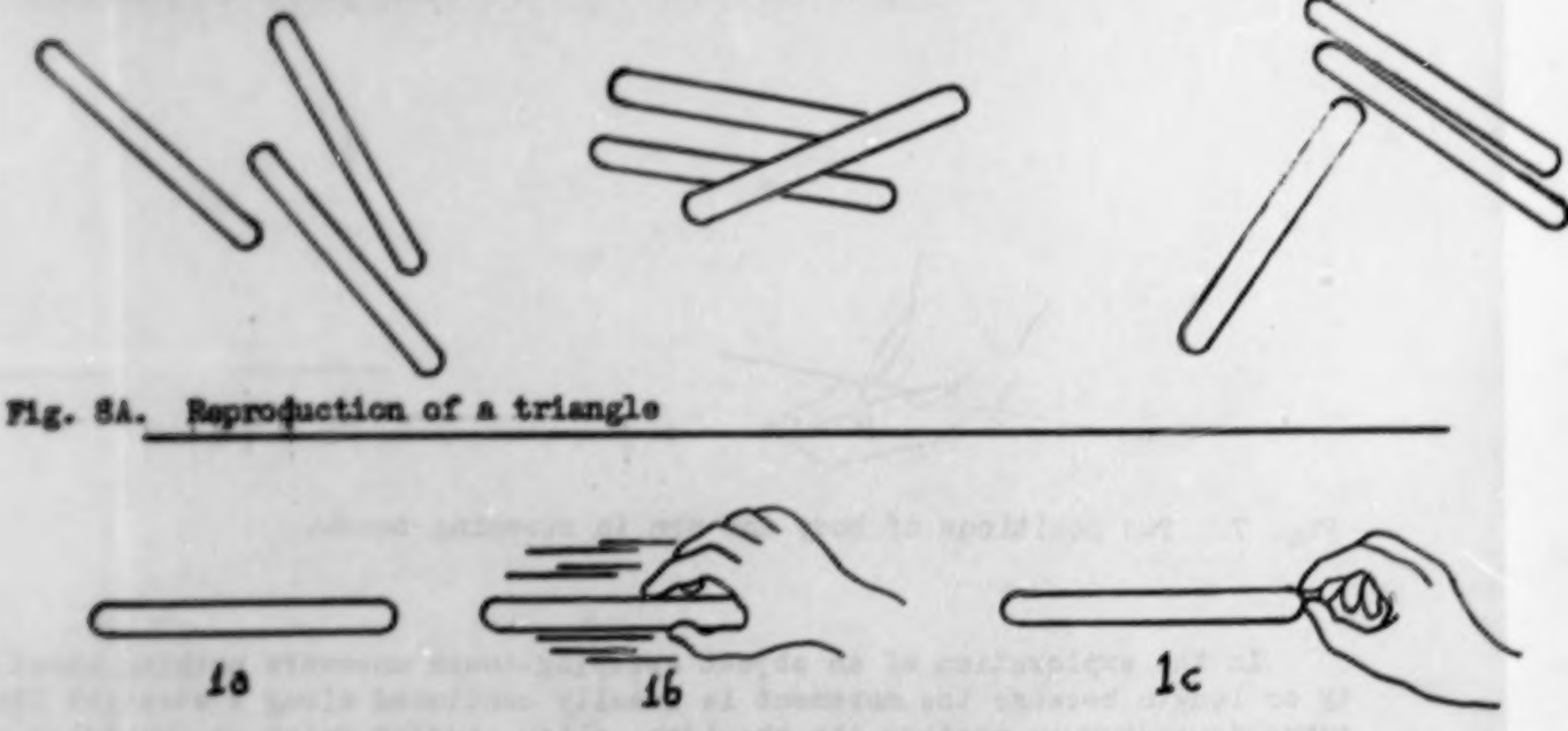


Fig. 8A. Reproduction of a triangle

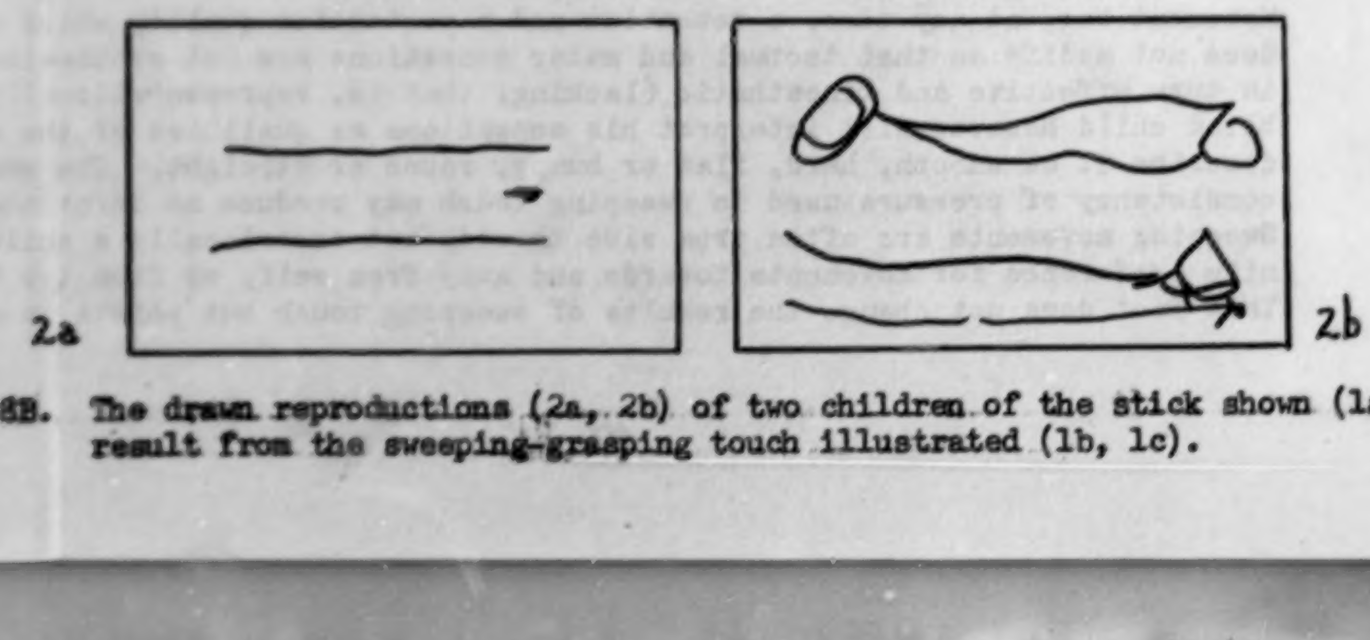


Fig 8B. The drawn reproductions (2a, 2b) of two children of the stick shown (1a) result from the sweeping-grasping touch illustrated (1b, 1c).

The articulation of the fingers and thumbs is important to the relative efficiency of grasping touch as it determines how well the motor pattern may be defined, and how clearly sensations may be distinguished, in relation to one another, and synthesized in relation to the motor pattern. So from grasping touch, in raising degrees of efficiency, one passes to structuring and metric touch and from representations of extent of surface, length, and consistency of texture and material, to the representation of structural relationships and finally of proportions.

Structuring touch: Structuring touch is analytic and synthetic: both hands are used in the active exploration of the object to comprehend volumes, maintain the orientation of the object while breaking down the surface into planes of various directionality, define planes by their shape, refer directions and shapes to symmetry and volumes, to reach a representation of the form of the object. This process requires not only the awareness of tactual sensations, as sweeping and grasping touch do, or the awareness of the relationship of touch to motor activity, as in sweeping-grasping touch, but also the awareness of the object-directedness of the motor pattern which thus acquires symbolic value with reference to the structure of the object. Movements not required by the structure of the object but intentionally directed at the exploration of details or at checking back, do not break the unity of the motor pattern and analysis takes place with the awareness of the presence of a synthetic structured unity, and with the expectation that the completion of any analytic exploration is a new abstractive synthesis. The representative value of the motor pattern itself is transcended in the emergence of form, which is the meaning of the object qua spatial pattern. The tactual muscular sensations accompanying exploration, are realized as qualities of the object and organized in terms of this specific form in a synthesis of spatial and qualitative values which is the meaning of the object. The object is thus comprehended or learned, it can be named. Metric touch adds to this representation the specificity of proportions that identify the particular object and at the same time make possible class generalizations and future recognition.

As the various aspects of an object are observed intentionality anticipates a possible order and envisions an object which actually is the phenomenological object, or, in other words, it is the object under the guise of a particular appearance in this occasion of experience. This may be called a percept. As such, this object is real, though not necessarily the object-in-itself which is less, and perhaps other than, its appearance or plurality of appearances. To know the object-in-itself is to reach a synthetic unitary representation of it outside of any perspective. Structuring and metric touch go beyond the immediacy of perceptual representation and rationally analyze spatial relationships and proportions to uncover the order by which these data may be organized in a representation of meaning. Perception ends when knowledge begins with the abstractive synthetic reduction of percepts to a unitary image that recreates the object as a totality posited as absent and non-spatial (i.e. non-phenomenological). The same object appearing in a new occasion may be immediately recognized but then the percept is regarded as symbolic of the object.

The preceding pages have attempted to describe the relevance of the object and of motor, sensory, and mental activity to perception and to show how each perceptual element may be influential in determining the meaning of experience. It is now necessary to examine the role of language in perception and in the organization of space.

Language

Blindness limits the experiential environment of a child to the space of his actual movement and to the space that he can, at each moment, comprehend with his arms. Currents of air and sounds enlarge this space but during the first years of life, and in some cases for many more years since, they do not convey informations about the spatial environment. A voice at first signifies body sensations, then it identifies a person, then perhaps an affective state, then, slowly, becomes distinctive sounds and words that the child learns to comprehend as sensations first and as nouns later. Speech develops as hearing becomes attuned to finer discriminations.

Music or in general rythmic sounds are often translated in rocking movements even by very young children. Other sounds, such as steps, bells, barks, etc., have an emotional significate and eventually become associated with words only indirectly related to them. The blind child learns that sounds signify the presence of a person or of an object only when he has identified the sound together with a direct physical contact with the person or object. As he begins to walk he may realize that presence at times implies distance, and use sound localization as a means of orientation, but localization remains vague and its use probably unconscious. The voice of an adult may appear to a child to come from a place quite unrelated to the place where the adult is: for him the height of a person is probably determined by the height he can reach with his arms. A blind child, to use the spatial clues of sounds, must know the nature of the sound, its direct and indirect source. Language usually is far too vague and inexact to help, as for instance when a mother explains the noise of a key turning in the lock by saying that "father is coming in". Similarly a bark is a dog, a ring is a bell, a siren the firemen and neither the dog, the bell, or the firemen are anymore or anything else than the noises that have been given their names, while the noises themselves have acquired the concreteness and identity of their source or of their causes. The child learns to use these words and is capable of communicating but may even never discover the difference between a bark and a dog or he may, later on, become aware of some ambiguities and find it very difficult to explain what he means or to find the source of his errors.

The child's own experiences do not correspond to the explanations that often accompany them, for instance walking is coming or going, sitting in a car is taking a ride or going to visit someone, getting out of a car is arriving somewhere. As he grows and his learning becomes more verbal his perceptual world becomes disassociated from language. When language is deprived of its symbolic intention the child finds himself unable to express and communicate his perceptual experiences or even to understand their meaning. Throughout centuries of civilization there has not been one congenitally totally blind poet or writer of some literary merit, and one may assume that this is not due to the fact that blind people have nothing to say. The same holds true with music: there are many blind players but not a composer of renown. Sculpture is the same. It is not that blindness deprives a person of his creativity or sensitivity, but rather that the blind child may be unaware of the possibility and the means of self expression.

A child is given a spoon and told to put it in the dish but the hand that guides him pushes his own hand down and he eventually learns a movement which is "the putting a spoon in a dish". When the size of the spoon or of the dish changes and his gesture loses efficiency he has no way of correcting it because he has no idea of the relationship of the spoon to the dish and of his movement to the position of the spoon. Someone may give him verbal directions such as "higher" or "lower" or "hold it even" and he will be confronted with the task of interpreting these words in terms of the movements of his arms, which to him are purely proprioceptive sensations.

Eventually he will learn the movement and that movement for him will be expressed as "higher", "lower" or "holding a spoon even". The same directions given when he carries a dish however will result in a movement that this time is the wrong one, and he will learn another movement, "holding a dish even". So, often, when he tries to apply language to experience he must conclude that neither language nor experience can be generalized, but that every instance of experience corresponds to an expression or word, and, conversely, that an expression names an experience, as his own name him. Also, looking at it from the standpoint of language he finds that not the noun, nor the verb, nor the adverb, nor the adjective are what make the difference or directly explain his experience, as for instance in the two expressions "hold the spoon even" and "hold the dish even".

In school he learns that north, south, east and west are directions and that North is stretching your arms straight in front of you, and South folding your arms back towards your body keeping your hands together. He has learned to find north and south and that is what "directions" mean and to "go north" or "go south". Another child realizes that when he stretches his arms to "find north" he touches the map on his desk, just about in the middle of the top edge, so all he has to do is find the middle: start from the edges of the desk, or the map, at the same time with both hands and move them towards one another till they meet, and that is where and what "north" is. And "south" is the middle of the bottom edge, "east" of the edge to the right and "west" of the edge to the left. Once you use your right hand, the other time the left, go up and down along the edge a couple of times then half way as far, just don't stretch your arm all the way, and that is where "east" or "west" is, and that is what "the middle" means. Now he knows what it means to be in the middle of the play ground or in the middle of the room: stretch your arms straight in front (or straight across) and let them fall down along your body and you know that you are in the middle. It is the same thing to sit in the "middle of somebody", like in the car or on a bench. The edge is a different thing from the middle, it means that you fall off, sometimes only your arms, as on the (top of the) desk sometime all your body as on a sidewalk or the swimming pool: you walk straight ahead or move your hand and then you fall off, and that is what "edge" means. It is easy to tell that the desk has two edges and a point, and the point is also called the middle. The top of the desk instead is all round one could also say that it is square, though, or rectangular, it is the same thing: the hands move round and round on it. It is also flat, or one could say slippery or smooth or narrow. It is the same thing with the face, it feels flat when you put soap on it. Finger painting as he used to do in kindergarten is flat and round too, most things are.

A small child talks about his world and sometimes he makes sense, sometimes he does not and often he is told "we don't say" this or that way, "we say..." and he learns to say as "we say", and because what "we say" is different from what "it feels like" it is only confusing to try and find out what things "feel like", and also the things he knows from what they "feel like" "we" call by another name, like "putting the spoon in the dish" actually feels like going down, or "crossing a street" really means stop and listen till there are no cars then walk straight ahead.

The preceding illustrations of some differences in the perception of a sighted and a blind person try to show the function of language in the experience of a blind child and to explain why some children with very high verbal ability may not be able to follow simple directions or perform efficiently and independently the tasks of everyday living. The examples cited were derived from responses given by children during the course of this study.

METHOD OF TEACHING

The experimental nature of this program suggested the desirability of manipulating the order of presentation of the various phases with the possibility to gain some information with regard to transfer. The groups, however, were not sufficientl homogeneous, nor the total time allowed sufficiently long to warrant comparisons by statistical methods. From the standpoint of teaching the sequence suggested in the preceding outline was found to be the easiest to follow with a young group as it is closely related to the development of motor and language skills. When older childre are concerned, however, several factors must be taken into account in selecting a starting point if the program is taught as a "special" program. Factors that were felt relevant during the course of this experiment are chronological age, intelligence, degree of academic retardation, homogeneity of the group in relation to the preceding factors and to areas of individual difficulties in spatial organization. In some localities, season variations must be considered, too, in relation to time allotment and facilities available. In some cases, it is possible to follow the regular sequence but approach it from the standpoint of language rather than activity and use activity to demonstrate meanings and illustrate alternatives. This approach may lend itself to a greater integration of the program by cutting through all the phases at various levels, i.e. motor skills, balance, posture, direction, position and developing each in terms, i.e. of shape or form thus at each level integrating aspects of perception of self, of space and objects that may come under the same verbal heading. Since this approach may at first be very slow because of lack of skills, careful and repeated interpretation of the aims of the program is necessary. In some cases, language may be considered too abstract a starting point and each phase either too childish or possibly too frustrating, it may then be desirable to start with some simple practical task, i.e. making peanut butter sandwiches to introduce the idea of surface, the use of a knife in relation to this surface in two different positions, to spread and to cut. Bread has texture and shape, the latter is varied and changed at will by cutting. A sandwich is cut in half across from side to side, from top to bottom, or diagonally and, if the timing is good, it is a high interest subject. Activities of this type at the beginning of the program have a psychological advantage while offering the opportunity to observe specific needs, individual attitudes and understandings. They may also motivate further practice and encourage confidence in progress.

The outcome of a program of spatial organization depends to a great extent on the children's understanding of the purpose of the activities performed as they are required to examine their motor and verbal habits and in many cases change them, at times, to carry out activities they would ordinarily label "babyish" and may instead recognize as meaningful and desirable in terms of their present problems. The attached lessons on veer correction and on the use of sounds illustrate this point.

Another point worth making because often overlooked in the education of the blind child is that the continuous repetition of an activity once learned does not result in reinforcement nor reduce forgetting as evidenced by the fact that a poorly oriented child may be taught to go from one place to another but even though he may go every day to the same place, he is not learning his way better, rather he is gradually forgetting it and eventually has to be taught again. The teaching of orientation should help the child find those perceptual clues he is capable of interpreting and remembering. He may be helped by perfecting motor skills, understanding the meaning of postural shifts, correcting veer, maintaining balance and direction, learning to synthesize tactual-kinesthetic sequences into spatial patterns through schematic drawings but he will have learned a method for finding his way around only when he will be able to select and use the perceptual clues the environment offers, for then he will be able to check on his errors. Whether he memorizes a particular route and can remember it through the years or learns it and forgets it within a few days is for the purpose of this program completely immaterial. This same consideration holds true for all phases of spatial organization and this, again, points to the importance of the child's attitude, and since learning to please an adult, teacher or parent, in this case has absolutely no value for the child, to the teacher's responsibility in a program of this nature.

It is now possible to supplement the very brief outlines of the phases of the program already given with more concrete descriptions and specific suggestions of activities that were found useful and appropriate during the course of this experiment. Each phase is presented as if it were the first one.

Phase one: Posture, position and fluidity of movements.

Awareness of posture and fluidity of movements depend to a large extent on the child's attitude towards space: unless he is sure of his surroundings, and feels safe in moving about he is hesitant and slow in his movements and more concerned with fear of obstacles than with proprioceptive sensations. It is important, therefore, to introduce the child to the training room pointing out empty spaces, walls and furniture, encouraging him to walk around, explore the room, reassuring him and vocally guiding him. After this has been accomplished, and it may take one or more periods, it is desirable to establish one point of reference. Lesson plan 1 suggests a way of doing this: in this case, the reference is given both to the wall and to the other children to facilitate the task of remembering and to encourage awareness of the others in the group. This point of reference is helpful at the beginning, mostly to give the children a feeling of continuity from lesson to lesson, a place to start from, and to go back to. With younger children, this is important and often also with older groups as this program deviates from the more orderly and rigid routine they are used to. Rolling on the floor, walking on all fours, imitating trains, running all together, standing and lying down side by side, walking holding hands with outstretched arms are all activities that help the children to evaluate the empty space of movement and gain assurance of the evenness and solidity of the floor. As they acquire confidence, they can be encouraged to run alone and specific instruction may be given. Imitating animals' ways of walking and movements of toys stimulates imagination and helps control of movements. Rhythmic music, clapping hands while walking, and in general all games suggested for young children may be used to teach the children to stop and go, to listen, get ready, alternate fast and slow movements, etc. More specific postural exercises may be found and adapted to individual and group needs, not necessarily as corrective training often specifically provided by a specialist, but rather to develop awareness of sensation, to explain meaning of position. This is especially important with children who often sway back and forth or sideways. Position may be stressed by emphasizing range of movements and limitations when the child is standing facing a wall, with his back to the wall, or lying on the floor. To encourage differentiation of "stiff" and "relaxed" it was found useful to have children play a relay game, sitting on a chair, picking up the ball between their feet and passing it to the next child by rotating towards him. The aim was not to let the ball fall and, naturally, speed. Walking on tip-toe with stiff legs, hopping and skipping often needs to be taught together with the meaning of stooping, bending, squatting, etc. Activities learned indoors should be repeated outdoors. Vocal contact in running is at first essential but at the same time the children should be encouraged to follow sounds (steps, bells, etc.) then to move as quietly as possible and listen as carefully as possible. In general, each lesson should try to relate freedom and control of movement to postural sensations and the cessation of movement to position not only as static but as oriented, as i.e. facing a wall, beside a table, etc.

Phase 2: Structuring extended space.

Extended space, or surface, is made up of a series of distances in a continuum of directions. The shape of a surface may or may not be important in itself, it depends on its size. If shape is important, the surface is limited by a perimeter which, in some cases, is all we know or need to know about a surface but this reduces the surface to a "road around" and possibly "roads across" it. This is true for the space of locomotion as well as for the brachial space. This phase of the program is concerned with the development of the concept of surface as something extended, even, stable and enduring; with the understanding of direction and location; and with shape. It also aims at showing how these concepts may be transferred from larger to more limited space.

Activities to demonstrate the meaning of surface may include rolling on the floor, walking on all fours, chasing a ball or a marble, games such as relays and passing the ball, rolling it and throwing it to children at different locations each time vocally identified. Occasionally metal balls or heavy wooden ones should be used and the sounds and echoes made by the different size and different material balls recognised and used in following and retrieving the ball. Rolling objects on the floor should also give impressio of smoothness which can be reinforced by stressing the difference with the noise made by objects sliding. A board with raised rims may be used on a table or on the floor for marble games with children on all sides, to shift to a more limited space. It is important that the children represent these various experiences by means of drawings on mylar or symbolically using sticks or ribbons or other markers to show the place of the players as well as the route of the ball. Clay on cardboard mats may also be used but perhaps drawings are the most efficient means to bring about a synthetic impression of the whole situation. Children learn quickly to use the mylar and soon begin to invent their own symbols to represent people and movement. As the children play with the ball or with cars sending them from one to another alongside and across the floor or the table particula care should be taken to identify the various positions and directions, the order of the game changing often and the children should learn to use the correct words to indicate relationships such as across, to the right, to the left, etc., with regard to themselves and to the other children. Placing a small bell in the middle of the table or of the floor space and attempting to hit it with a ball, or similar games offer a good chance to identify various positions and directions with regard to an object other than the children. Have them describe their drawings using correct terminology. From this it is possible to introduce the concept of veer and clarify the meaning of "going straight". It should be made clear also that to say go straight is not sufficient, and also the direction of going must be stressed, such as ahead and backwards, towards the table or the door, away from the wall or the other child. The blind child may not be spontaneously aware of the fact that in going towards a place he is at the same time getting farther away from the starting point but this is the first step in objectifying the space of locomotion. Ribbon may be useful in helping a child retrace his way or realize distances. If a ribbon is anchored at various places while a child walks around a room he may be able to identify a shape that he has walked, and compare lengths of sides, two sides and diagonal. Finding himself within the space enclosed by the ribbon may reinforce the idea of shape as space as space enclosed. Ample repetition should be given to this type of activities, gradually extending the area of movement and each time encouraging symbolic, graphic or otherwise, reproduction, to reduce the space of locomotion to brachial space. The meaning of straight that applies to walking also applies to drawing and in both cases posture should be carefully observed.

Veer can be explained rather simply as shown in the attached lesson plan, which was used with children of varied age groups: the smaller ones viewed it as a game, to the older ones it was introduced with an explanation of the purpose. With either groups results were good, the children appeared to understand and soon began to practice outdoors in going from place to place and asked to be observed and corrected. This lesson was repeated periodically till the children were aware of postural shifts accompanying veering and began to be able to correct deviational errors. Again drawings accompanied activities to illustrate meanings and view the situation objectively. No attempt was made on the part of the teacher to present the children with ready-made drawings because it was felt it would take a much longer time and more experience before the children could interpret a drawing made by another person. They drew the various activities themselves, and whenever they were not sure or appeared confused in explaining their drawings, activities were repeated and followed by new drawings.

Instead of drawings sometimes children were asked to represent a situation or illustrate spatial relationships by acting it out with the help of the other children in the group. So a shape could be represented by locating children at the corners or along imagined sides with their arms stretched out. Locations were indicated by sounds. Guessing games are possible and usually well enjoyed: four children representing the angles of a square makes the same sound at the same time and a fifth one guesses the shape, then the children move to form another shape or one remains silent and the square becomes a triangle. Interest and novelty are great helps in stimulating quite refined differentiations. Acoustic shapes may be used also to point out relationships of inside and outside of buildings, identifying and locating windows and pointing out size of buildings. This is important because children do not seem to be aware by walking subsequently in different rooms, of the contiguity of rooms, of the orientation of the rooms in regard to one another and with respect to the outside. As they become aware of these relationships the first maps may be drawn, with sticks and ribbons and wires or on the mylar. Buildings may be represented by real brick walls on the floor, smaller bricks or blocks on tables, and clay structures. It is important to proceed gradually from as complete and realistic a representation as possible to a more schematic and symbolic one. When the children have had enough practice it is possible to use abstract shapes to indicate locations, as from buildings one passes to playgrounds and campus. The use of symbols marks the passage from a motor and temporal approach to a truly spatial one. Ribbons and drawings usually indicate paths, corridors, streets or ways to go from one room or building to another but a square symbolizing a room is a definite location and whatever is built around it should be in terms of locations, and exact relationships should be stressed. If possible, models should also be used. Throughout this phase pointing, turning towards places and verbally describing directions and locations should be stressed. Turning may require special training especially if children tend to sway: from standing still in a position easily identified they must learn to turn right and left: this is quite difficult to learn and to teach. Older children may be explained the meaning of turning around as different from turning right and left in terms of degrees, but in general a mechanical approach is needed in all cases. During this experiment it was found possible to give the children some understanding of the amplitude of an average right or left turn by breaking down a continuous turn-about into four steps so that after four partial turns they would find themselves in the starting position. When the child has the habit, which was found frequently, of swinging his whole body from the shoulders and rotating on one heel, he must be shown how he can turn by changing the position of his feet, at first one foot at a time, then normally both. With older children it may take quite some time before a 45' degree angle is mastered, even though they may be quite able to define a 45' degree angle verbally. A compass and again mylar may be of help to exemplify meanings but actual practice is needed to correct a faulty and learn a new motor skill. Younger children appear to learn more easily, motorially at least. This suggests another observation: turning may be emphasized also in having the children walk around a table closely following the sides and the corners, provided they are able to maintain the same position with respect to the table. All too often they follow the sides of the table walking sideways. As it was mentioned earlier in this report the child learns slowly and needs to be taught to view objectively his position with regard to other objects as he usually tends to refer all positions to himself. Maybe this concept of the reciprocity of positions is difficult if not impossible before six or seven years of age, however, some children appear to develop it earlier, at least at a functional level. Doll play, puppets and some of the ball games mentioned earlier may prove of value in helping the younger child to view a situation as "facing" him. Another game that arose great interest was "pat-a-cake". Naming the hands and frequently changing places may help. In a similar way may be used a stable source of sound, such as a clock or a timer, having the child walk to it, passing by it to the right and left, etc. A continuous description of the activity while it is taking place is essential.

__Phase 3__: Perception of Objects

This series of lessons is specifically concerned with the space of objects. It purposes to teach children to observe and identify objects through the selection and analysis of their tactual characterisitcs.

A. 1. Density: Presentation of objects: things we eat.
   2. Observation of differences in density: liquids we sip, other things chew, others are too hard.
      compare: water, orange, apple, marshmallow, bread, lollipop.
      (b) Some things we can squeeze, others cut, break, poke. Things are spongy, rubbery, stiff, etc.
   3. Collect items of different - similar densities
   4. The same material (i. e. rubber) may have different densities in different objects. Relate density to: use of objects, types of materials.
   5. Changes brought about by heat and pressure, and water. What happends to the bread left in the air, toasted; to the lollipop left in a glass of water, to a candy bar on the radiator, etc.

B. 1. Presentation of common-use objects: things we eat
      things we wear
      things we use
   2. Analysis of textures: the way things feel.
      1. Wet or dry, sticky or smooth (soapy), slippery
      2. Smooth, rough, wooly, silky, prickly, velvety, waxy, furry, stiff.
   3. Naming textures and classifying objects.
   4. Using textures to represent objects: symbolic use of materials.
   5. Textures vary but some types of objects (i.e. fruits) always have the same texture: texture as basis for recognition of objects.
   6. Some textures are more pleasant than others. What textures we remember more easily.
   7. Some objects have different textures in different parts, i.e. fruits. The whole object should be explored.
   8. Textures suggest types of materials but are not sufficient to identify materials or objects. Painting, sanding, wetting, scratching, etc. change the way things feel.
   9. Application: Matching textures, reproducing, changing textures, collecting objects with the same textures.

C. 1. Shapes: Presentation of objects: things we eat
      things we use (tools)
      clothes
      furniture
   2. Naming shapes and classifying objects by shape; round, spherical, eliptical, cylindrical, conical, rectangular, square, oval, etc.
   3. Generalization: grouping objects with similar shape.
   4. Shape tells something about the use of objects: dishes and cup forks and spoons, handles, keyholes, knobs, soap dishes.
   5. Regular and irregular shapes: The need for exploring the whole object: How to touch.

6. Objects are often made of parts: each part has a shape different from the object as a whole: taking objects apart: organge, lollipop, corn from the cob, pages from a book, etc.
7. Our body is made with parts of different shape: hands and arms and legs. What are they like?
8. Our clothes have different shapes and are made of parts. Some parts are alike: sleeves, etc.
9. The shape of things make them do different things: something round rolls, flat things slide, etc. What happens when things fall: how to look for things. How do we fall, roll, curl up, stand straight, etc.
10. Shape of containers: things that fit inside, i.e. feet and shoes, hands and gloves, jelly in a can, shoes in boxes, etc.
11. Applications: recognising objects by their shape, parts that belong together, identifying shape of different parts of objects, changing the shape of objects. Making shapes with different materials, two and three-dimensions, making molds. Recognising pleasant and unpleasant shapes, appreciating the effect of sudden and slow variations.
12. Using shapes to symbolise objects.

D. 1. Sizes: material: id.

2. Compare a sip, a mouthful, and a glassful of water; a peanut and a mouthful of peanuts: a little and a lot.

3. Big things and little things: the clothes of a child and the clothes of adults (large ones that is). Baby's first shoes and the children's.

4. Things of the same shape and different size: tables, etc., fruits, dishes and cups.

5. Some things are so small we can hold them in our hands, others we can hold with our two hands. Other things are so large we must use arms, and sometimes they are too big for us to touch them all over. Recognising little things: general shape and larger things: details in relation to general shape.
6. The size of parts gives one knowledge of the size of the whole. Little feet and little people, etc.
7. Size alone does not help much to recognise objects but helps to identify them and compare. - i.e., the size of a pair of shoes, gloves, the size of things that fit together.
8. Touching for size: maintaining constant one relationship, touching for shape and size: symmetry: using metric touch, the hand as a gage and two parts of an object as standard for the others. Differentiating enveloping touch from analytic touch. Movements help to determine size: length of table.
9. Size appears different to different parts of the hand (palm gives enlargement): the use of fingers and wrist in touching.
10. Reproducing sizes through gestures and motor activity. Making things of different sizes, grouping things by size.
11. Size as an element of orientation: big things never move, larger things at the bottom and smaller things on top, the outside is larger than the inside. Things can be ordered as to size.
12. The size of an object and the material it can be made out of: usually, the bigger the object, the stiffer and harder the material. The size of many objects is related to their purpose, and the use we make of them.

As this phase of the program develops, it is possible to relate the structure of objects to body space by imitating with attitudes and positions the relationships between parts of objects, such as perpendicular, parallel, at right angles, etc. Paper and cardboard constructions were found useful and interesting to use, and some of the children spontaneously transferred the same idea to building with clay, joining faces, regulating sizes of corners, schematizing more complex shapes towards geometrical simplicity. Differentiations between shapes and forms became soon spontaneous as the children undertood what was better represented with drawings and what with plastic or solid material. Interesting were the drawings of cubes, cones, cylinders and simple objects some of the children attempted. They started from representing separately the various elements they had uncovered, then organized them as if the object were open, and gradually sought to represent relationships as they appeared in tactual perspective thus producing drawings that strongly resembled visual perspective drawings. It is interesting also to note that the younger (5½ year old) children when first beginning to draw started with scribbles and within 4 or 5 months passed through the normal scribbling stages using lines and circles to illustrate stories, and gradually mastering control of movement and pressure. Some of the older children went through the scribbling phases very rapidly but in most of them the same development may easily be seen.

Copper sheets with line drawings were presented and left around in large numbers to encourage children to explore them. The children did some copper drawings too, especially when they needed to learn to use more pressure and evenness. On the whole, copper has the disadvantage of reversing the drawing and is therefore less useful than mylar.

Phase 4: Language

This group of lessons is specifically concerned with structured space. It purposes to teach children some of the ways in which space is organised and to clarify, through experience, the meaning of words that, because of their visual character, are often ambiguous when applied to the experience of the blind child.

For the purpose of these lessons structured space will be considered as the relationship of: 1. linear space or direction and distance, 2. Position, absolute, of self and of objects, 3. relative position, self and objects, 4. relationships between locations, enduring, and 5. internal organisation of objects. There are certainly others, and perhaps more important aspects of spatial structure but these were selected as the simpler to teach to young children with the method suggested.

1. **Direction:** Static: facing the wall, facing a person, facing the sun.
Dynamic: walking towards the sun, walking towards a person, towards the wall. Pulling and pushing. Pointing. Reaching in front. Stopping in front of something.

Vocabulary:
Facing
towards
forward
Ahead (straight ahead)
here
there

2. **Direction:** Static: right and left side of the body, right and left hands. Standing beside wall, person etc. to the right and to the left. Swinging right/left arm.
Dynamic: moving to the right, left, turning to the right or left, pointing towards the right or the left. Walking to object on the right or left. Swinging body from left to right, turning knobs.

Vocabulary:
to the side
right-left
this way, opposite way.
Beside
direction

3. **Direction:** Static: standing against the wall, laying on our back, standing behind somebody, having somebody in back.
Dynamic: bending backwards (literally), walking backwards, swinging arms towards the back, back and forth, walking back and forth, swinging body back and forth, swinging on swing, swinging a pail of water. Carrying a sack on our back, dragging, pulling, etc. Reaching in back of object.

Vocabulary:
around
backwards
away from
backing up and away
against

4. **The cardinal points:** facing the sun: the sun as point of reference to determine our position and the position of objects (here position is only used to mean: what side we are facing). East and West: morning and afternoon. The sun in the room: when and what it means. Right and left, and North and South. Facing the sun and turning around. Turning the right side of our face towards the sun, the left side and facing North or South.

When the sun shines on the front door, the back door of the house is in the shade (timing of this investigation is most essential).
A building has a front and a back, like we do.
A building never (hardly ever) moves so each side of the building always faces the same direction. Orient building. Dramatize meaning of 'facing' and distinction between front, back, and sides. Sandbox or table demonstrations or relationship of sun to building at one given hour of day.

Vocabulary: Cardinal points, names.

5. **The cardinal points as indication of direction (as other than position)** Buildings do not move, roads do not move. Like the building, roads are laid out in a certain position so that each side is always turned to the East, the other to the West etc. Lay down on floor to demonstrate the four sides of a road and why we walk North and South etc., but walk on the right-hand side or the left-hand side of the street. Demonstrate also spreading roll of paper on the ground. Emphasize: going towards East, going West as walking in a certain direction. Give a lot of practice.

6. **Distance:** People can be so close that they touch, so crowded that they cannot move, and they can be a little apart so that they can touch one another only if they reach out, or so far apart that they cannot even reach, even if all stretch their arms out. The same thing happens with the wall, the door, the table and with our hands when we clap them: first they are apart then we bring them together and they make a noise. Objects can be close together or far apart, like homes and people and your hands. The sides of an object can be close together or far apart, the edges of the table so that you have really to reach far away to touch the edges with your hands. Things can be far enough that we cannot reach them from where we are but near enough that we can walk to them, or so far that we cannot walk to them but must ride or fly. Then there is a great distance between them, and we must go a great distance before we get to them, like many of you travel a long distance to come to school or to go home. But when we travel the distance becomes shorter and shorter till we are almost there, and then we are there, and there is no distance any more. (use demonstration of road again) Demonstrate with string held by one child while other child walks away unfolding it.

Vocabulary: together (spatially)
Between
nearby
end
apart
close
edge
opposite side

7. **Distance and direction:** First we talked about going East, etc, then we talked about distances and going a long distance and a short distance and we talked about going home, coming to school. When we walk, or ride we go towards something that is East or West or North or South. We travel a distance in a direction. When we go from the door to the window we go, i.e., East. Are there other ways of going to the window? There are many ways of going different

places when we know where they are. (demonstrate on sandbox, floor) If we know where we are and where the place where we want to go is, we can find many different ways of going there. If we know that a place is East we can go there, as long as we walk in that direction. But some ways are longer, others shorter. We can go to the window by going around the room till we find the window, or we can just walk across the room from the door to the window. (demonstrate with string). Sometimes we remember where things are and sometimes we forget. Sometimes we can remember where things are by thinking of what they are near to, or by thinking of other things we find on the way. (Demonstrate). Sometimes we can go places by walking in the same direction of other people, following the noise they make, or towards the noise of cars. Objects, buildings, noises can all help to guide us towards a place. They tell us in what direction to go, and also how far we are. (Demonstrate with sounds). Building city in sandbox demonstrate different ways of going places. Have children represent different cities or buildings and others walk to them, roll balls etc. Use cardinal points as locations. Build park with walks, benches, trees and people, progressively structuring whole space and parts.

Location: Where we are: outside, inside, middle of the room, corner. Identification of place in relation to self. Here and there as definite location: in 1. here and there were used as directions. This material has mostly been covered but should be reviewed carefully at this point to separate the concept of location from that of movement. It is important that the children should have clear the idea that a location is different from a position, it refers to a determinate place, not a way of being, the way position does. Discussion and demonstrations aimed at clarifying doubts and misconceptions. Age of group and individual differences make too much difference for any specific description of procedure.

Position: the relationship between parts, and betwpen wholes. When we move the position of our body changes: we put one foot in front of the other when we walk, we put our hands behind our back, above our heads. We swing arms and legs, rock our body. We stand up, sit down, fall down, roll over, stoop, bend, we can even stand on our heads (demonstrate) but everytime we do something we change our position. We can change our position fast or slowly, very fast or very slowly. We can remain in the same place and change our position: we can stand here or sit down here, or we can also move from one place to another. We can go from one room to another and that is changing our position, or we can go under the table and stand on the table and we have changed our position. When we go to another room we change our position because we change place, when we stay here and sit down or lay down we are in the same place and we have changed only the position of our body, everything else is still the same, all the things around us are the same and we still know where they are. We can paint a room and the room remains the same, just as big as it was before. We can set a clock at a different time and the clock remains in the same place and we still know where it is. We can take a drawer out of a bureau, and the bureau remains in the same place. When we open or close a window the window does not move, only part of it does, but we know where it is and can always find it. Let us find out what happens to the other things when we move, because even if we know that they are still there they seem to be different, and sometimes we get lost in our home. Let us start from a table. We all know this table how tall it is, how large, smooth etc. We are sitting at this table and the table is in front of us. Now we are going to sit under the table and see what the table is like from underneath. (do and have children examine table). It is quite different. The top of the table that was in front of us before and felt smooth, now is above our heads, it is like the ceiling. The top of the table is above us and we are underneath the table. To touch the legs of the table before, we had to reach down, now they are beside us. We are between the legs of the table. If we try to stand up we find that the table is too low for that and that our heads hit the ceiling. The table now is different and we would have a lot of trouble to recognize it as the same table we were sitting at before. The same thing happens sometimes when we move and find things from a different direction. Things have many sides and we know them well only if we know all sides. How does it feel to be under the table? It is like a tiny room, there is just enough room for us. Now let us see what it feels like to be upstairs, on top of the table. Let's do that one at a time: One child on table Feet of A. are on the table, they are just above our heads. The table is like the floor for A. The table is the ceiling for us. The ceiling of a room is the floor of another room. The ceiling of the room underneath is the floor of the room above. Did you ever tap on the ceiling with a stick? (demonstrate). If we tap on the ceiling of our little room, A. feels the taps under his feet. If A.taps on the top of the table we feel it just above our heads. (demonstrate). A.is higher than all of us because he is upstairs. He is high up on the table and his head is way up. The bedrooms upstairs are higher than this room. (Demonstrate how higher by going outside and having one child call from window downstairs and another from window upstairs. Have children drop lines from window.)

Vocabulary:
above
up
low
underneath
down
on the top
below
high
bottom

10. **Position:** Table closed in with cloth. If we go under the table now this is really like being in a room, the cloth is the wall, the legs are at the corner. To go in we need to make a door. (discuss position of door). Cut door, get under table. Procede the same way for window pointing to relative position of window, height of window from the floor and distance from the ceiling. Now we are under the table but also inside a room. Our room is as large as the table. Does it feel as large? (Demonstrate). We now make another room with another table. What happens when we push the two rooms together? There is a wall between them and we cannot go from one to the other. Discuss possibilities: getting out of one and into the other or cutting door through.) We will cut a door between the two rooms so we can go from one to the other. Split group under tables. What happens to our windows? Are they on the same side? Let us look at our two rooms from outside. (point to position of doors, windows, to the way rooms appear from the outside, have child inside at windows. Let children guess in what room he is from his voice, or other sounds.) And what about the ceiling of our rooms? We said that the ceiling of our first room was the floor for another room, what about the

ceiling of the second room? Could we have two rooms upstairs? Is there as much room upstairs as we have downstairs? Could we make one room upstairs or two? How many walls do we need then? (Do it).

11. Position: Third room downstairs: Position of door, window. Leave second room as corner room. Point out difficulty of going from first to third room without going outside. Build corridor, open doors on corridor. Outside looking at doors and windows is as in 10. Child on top of first table, second, third, children at windows. Make clear all possible relationships of upstairs and downstairs, rooms on one side of the house and rooms on other side. Repeat whole procedure with children outside of building and other children calling from windows. Repeat with children upstairs and children downstairs in the building. Play games with children representing rooms, holding hands for connected rooms. Investigate distance between floor and ceiling in actual room. Reproduce house with blocks, boxes, chairs, etc. Reproduce process with pegs in place of legs of chair. Repeat with folding paper, and emphasize position of walls relative to floors. Let children assume position, laying down on floor and being pulled up.

12. The organization of other objects: Discuss, experiment with other objects that have sides, top and bottom, empty or full. Orient objects to cardinal points, to other objects, to surface of table, floor, ceiling.

Following are sample lesson plans:

PHASE I

Location: Indoors.

Equipment: 2 large sheets brown paper, 5 different little toys, masking tape, crayon.

Major objective: acquaint children with room, by establishing one point of reference.

Preparation: Place brown paper on wall opposite door. Place the toys around the room.

Minor objective: standing "tall"

Activities:	**Specific Objectives**	**Procedure**
Hunt for a surprice	To provide warm-up activity. To give opportunity to explore room. To observe behavior.	"How many of you have gone on a Peanut Hunt?" - If you like to go hunting around, you will find a surprise. You may go anywhere in this room." Inform child when nearing objective.
Identify toys.		
Measuring height	Locating wall Lining up along wall Establish position re: wall, other children.	Children stand in line facing wall See what is on this wall? Who can guess what this paper is for? - We are going to see how tall you are. But first we must put your name on the paper, to show where you are standing so you can find your place again.
Pin Brll names		I have a car, dog, etc, just like the ones you found. You all remember what you have. Let us stick them on the paper. Here is some tape for you, (place at shoulder height.) Let's make sure we can all find our marker on the wall and we all remember what it is. Who is the tallest? (Measure making heavy marks with crayon.)
Summary	Repetition	Before we go away let us make sure we can come back to the same place tomorrow. Let's see if we can all find our marker. (Help children) and let's make sure we remember who is next to us. Ask children to name others in order. Point out: first, middle, last And now let's see who is the first one to run to the door.

Location: room

Equipment: none

Preparation: none

Major Objective: orientation to the wall and to floor.

Minor Objective: awareness of change in body position.

Activities	**Specific objectives**	**Procedure**
Finding own place (review)	To provide repetition to encourage free movement.	From door: Let's run to the wall and find our markers. Encourage and praise running. Now let's run back to the door - Here (from door) where I am standing. Run as fast as you can. Repeat to wall.
Rolling on floor	To point out change in position. Tall and long: when we lie down we occupy space Distance from head to wall. Whole body movements	(Chin facing wall) Now let us all lie down on the floor to rest, right here where we are. Let's try to keep our feet just where they are. - Can you touch the wall with your feet? (take shoes off) Good, now see how well you can stretch? Keep your feet on the wall. Stretch - as long as you can like you do when you reach for something. Now your head is far away from the wall. How far is it? All rested? Then let's see if we can roll on the floor. (Call first child) You are the first, you must start folling first. Roll and roll to the other wall and we will all come after you. (Help). Now let's stand up and this time we stretch way up as tall as we can - way up on tip toes. And who will be first to the door today?

Location: room

Equipment: none

Preparation: none

Major Objective: enlarging space of movement.

Minor objective: awareness of change of position.

Activities	Specific Objectives	Procedures
Rolling (review)	Repetition Whole body movements Provide choice	Who remembers what we did yesterday? Would you like to do it again? Roll and roll like your crayons do when they fall off your desk. Roll and roll like a ball.
Imitating animals	Provide more creative experience. Variety of body attitudes and movements. Relate activity to other experience.	Let's play a new game: I am going to make believe that I am an animal you all know. You come over and see what I do. You can ask two questions. If you can guess what I am you whisper it to me. (imitate dog or cat laying down). Now it is my turn to guess. (let each child have turn) Teach dog run, giraffe walk, or any other. Make believe you are little babies - how do they walk?
Marching		and now let's make believe we are soldiers and stand up real straight and stiff and tall. Let us stand in a row one behind the other, stiff and tall. Did you ever hear soldiers march? What do they sound like? Think you can sound the same way? They walk all at the same time - let's do it. Let's swing our arms while we walk. (Show). Does it feel the same as the dog run? Do you swing your arms when you walk? Some people do. They swing their arms back and forth, back and forth, the way the swing goes when you swing.

Location: playground

Major Objective: enlarging space of movement.

Minor objective: muscular control.

Activities	Specific Objectives	Procedures
Walking	Practicing walking on uneven ground. Notice difference between pavement and ground: resistance, noice, smoothness. Directions: away from building, towards building. Distance	Yesterday we alked and ran inside. Today we are going to take a walk outside. We will walk on the grass and we will walk on the street. I want you to pay attention and tell me when it feels different. (Walk away from building) Who can tell me where we are now. How can you tell? How does the ground feel when you walk? Can we walk on all fours? Is it easier here?
Chasing game	Large muscle activity	Let's play: who knows a game? I'll run, let's see you catch me. (take turns) Maintain vocal contact.
Running		Let's run all together, let's all run back the way we came. Back at the bldg: was it far? How far did we go today? Was it as far as from the classroom to the dining room? Let's go back, and see how far it is.
Walking		Let's walk all together the way we walk inside without running, and without stopping on the way. (go to same place - discuss) then walk back pointing out direction.

Now let us go in. Tomorrow we will meet inside and you are going to find a surprise.

Lesson_______

Major Objective: Correction of Veer

Minor Objective: awareness of movement and posture in walking

Location: Room

Equipment: Strips of paper, the length of the room, in four widths, from 2 feet to 4inches.

Activities	Specific Objectives	Procedure
Making a path from one side to the opposite side of the room (review) using lengths of paper	Meaning of length, opposite sides, distance - distinguish length from width	Ask children to stand with back to West wall of room, point to opposite side, walk to it, lay out paper on floor, using lenghhs end to end Two children working together, others checking
Walking barefooted on paper path	Meaning of veer - walking straight ahead, across the room - as far as the other wall	Have children take off shoes and socks - walk, one by one, from West to East wall staying on path Present as game to young ones, explain purpose to older groups. Keep error score: foot on floor.
	Correct posture, articulation of foot.	Note and correct: position of foot and leg, deviation in direction. Practice till all childr can stay on largest path - then shift to next smaller width.
	For each child: keeps notes of direction of veer for consistency and of amount of veer.	Give individual explanations at level needed. Repeat with narrower strips till needed.
Running on path	Check and point out difference made by rate of walking, rythm	Have children run on path - maintain direction by vocal contact.

Note: Repeat activities till children are able to maintain direction, and are aware of directional changes: emphasize that it is up to them to count deviations.
Follow up with: id activities without path but definite reference (arrival) till awareness of extent of veer and at least correct directionality.
Repeat outdoors - then check children walking alone, coming and going.

Lesson: ________________

Location: Outdoors

Equipment: Ball, two different bells.

Major objectives: Sounds: follow, identifying source, resonance and echo: what they mean.

Minor objectives: attention to sounds

Activities	**Specific Objectives**	**Procedure**
Listening and describing sounds on street near building	**Identification, description**	**Sounds help us in finding our way around and they can tell us where we are when we are lost. Discuss. Let's listen....What can hear? Where does it come from? point. What makes it? What kind of a sound is it?**
Walking towards sounds	**Making specific source of sound and its localization**	**Select appropriate sound: e.g. motor of car, voices. ask child who described it to guide us there. Repeat**
Making sounds Clapping hands	**detect presence of bldgs, trees**	**Have children occasionally clap hands while walking, along building, on open ground: till diff. is noticed.**
Walking and making sounds	**Indications of distance**	**Then repeat walking towards building and away. Explain difference, have children explain: resonance Differentiate from echo: use porch, walking towafds and underneath porch. Only one clap hands.**
Following sounds	**direction**	**Only source of sound moves other children stand in same place. Children follow teacher's voice, steps, hand claps, bell.**
Roll ball, wooden, on cement floor	**Remembering and integrating sounds and variations in time**	**Children line up at one side of skating ring, T. rolls ball, varying direct. Listen, point to ball, by pointing follow course of ball - retrieve it.**

Note: Play as games and give explanations as understanding develops and practice becomes authomatic.

Note: Give special attention to children with difficulty in localizing sounds. It is important that also very young ones be explained - they can correct their error.

The Spatial Relations Performance Test

1. **Object recognition:**

   a. **Material:** Doll house furniture in 3 groups: 8 tables, 9 chairs, 7 pieces of furniture: 2 chests of drawers, 1 bed, 1 crib, 1 refrigerator, stove, sink.

   b. **Directions:** I am going to show you some things and I want you to tell me what they are. If you don't know you may guess. What is this? - the first table is presented. If child fails to recognize the first three tables this additional information is given: "These are models (toys is a better word for the younger children) and perhaps you have never seen them before but in your home you have things like these, only they are much bigger." Another table is presented. If this is recognized the other objects are presented in the order of the scoring sheet, if not the first chair is presented (after table 4). If this chair is recognized the regular order of presentation is followed, if it is not recognized the bed and the crib are introduced next (these are often the easiest items). Although all items are presented, to insure some success and give reassurance the order of presentation and the direction of the object when presented is varied with children who have great difficulty in recognition.

   c. **Scores:** Each item recognized is scored 1, non-recognized is scored 0. The time score represents the interval between the presentation of the first object and the response to the last chair (when the regular order is followed), and the time used similarly for the other seven objects. It is recorded as total time.

   d. **Identification:** After tables and chairs have been presented, if a sufficient number of both was recognized, all the tables are brought back in front of the child and he is asked: "Could you show me which one of these tables is more like the one you are sitting at?" A similar procedure is followed with the chairs. The child is then asked "to find a chair that belongs with each table."

   e. **Scores:** Table identification: 1-right; 0-wrong (only one possible right) Chair identification: 1-right; 0-wrong. Two chairs may be scored right, a wooden and a plastic one provided the child spontaneously states reason for choice: same shape but made of plastic.
   The matching of tables and chairs, since it is possible only with children who have recognized a sufficient number of both articles, was not given a numerical value. It was maintained in the test and given whenever possible since it makes possible some observations considered of interest.

   f. **Observations:**

      a. **Exploration of objects:** Hand used: right, left, both or either. Does he hold or pick up the object. Does he turn it over or around.

      b. **Orientation:** Does he put it down standing or not. Which hand is used to pick up or hold objects. Are the objects spaced or massed in the same spot. During exploration is the object oriented to the self, the table, or away from the self.

      c. **Touch:** Is the child using his hand as a whole, or are the fingers used independently, wrists articulated. Is he using both hands, in opposition, reversing. Is the thumb used in grasping and sweeping. Does he seem to use excessive pressure, downwards or against the other hand. Is he able to open drawers, can he replace them if he pulls (or shakes) them out. Does he attempt to rotate the drawer.

d. Relationships: Does he see the relationship between the drawer and the space left vacant by the drawer. Is he aware of the shape of that space, of the direction or is it just a hole. Does he investigate the inside of the drawer and cabinets. In matching tables and chairs what criterion does he use: random, size, texture, distance from the table top to the seat of the chair, distance from the top of the back of the chair to the table top, scale, details of style. Is his approach random, intuitive, analytic or synthetic.

2. Cars:

a. Material: Dinky toys: A truck, a jeep and a sedan, scaled.

b. Presentation and directions: Each toy is presented asking, "Can you tell me what this is?" The child is allowed a couple of minutes to play with the cars and make comments on size, etc. The direction and extent of his movements is noted and the hand(s) used. He is then asked: "Show me the biggest car, the smallest car . . . what would you call the other?". The car named correctly by the child at first or more closely approximated is then selected and placed in front of the child, headed towards the right or the left and the child is asked: "Show me the front, (back) of the car." In case of error the child is asked, "Can you show me what front (back) means?" Usually the child responds by pointing to his chest and back. He is then explained: "Just like you do, a car has a front and a back, a right side and a left side" and he is made to feel the car till he can identify front, back and sides. Then the other cars are presented and again the child is asked to show "which one is the front, where is the back,". When he can do that he is asked "Can you put them in a row so that they are all coming towards me . . . can you tell me which one is the first, what comes next, . . . last?" The cars are then put in a row by the examiner, headed in another direction and again the child is asked to find the first, the last and the one in the middle. The three cars are then placed side by side, back to the child, and the following explanation is given: "Suppose (let's make believe) that these cars are traveling on a highway. You see, they are all going in the same direction--and all cars are moved somewhat--. Show me which one is on the right-hand side of the road, which one towards the left". In case of error no further explanation is given but directions are repeated (show me, etc.) emphasizing "side of the road". The direction of the cars is then reversed and the relative position changed and again the child is asked to show the car to the right and left side of the road. If he has been mistaken both times he is asked to show which car is in the middle: the cars should not be aligned in this case. The same process is repeated with cars headed towards the right and the left of the child.

c. Scores: The cars are often identified and usually recognized, therefore, recognition is not scored. Right/wrong scores are given for: size, scale, shape, middleness.

d. Observations: Is the child recognizing or identifying the cars, i.e., are they toys or models? Is his activity organized? Does he realize that a car goes frontwards--before, after the explanation? Is the play-space employed manual or brachial. Arms extended or flexed? Movements: free or inhibited? Sequence: Can the child abstract himself from the situation and determine the order and direction of the cars, and their position in terms of frames of reference not including the self? Structure: Is he aware of the structure of the cars, can he relate this to direction of movement? How many and which directions can he abstract? Does he differentiate top and bottom of cars? If he plays with the cars is his play imaginative or purely motor? sound effects?

Does his space of movement extend perpendicularly or frontally, by what direction is it structured? Is one hand obviously motor or non-motor or does he use both?

e. Comments: While the length of this test may appear out of proportion in view of the few items scored, it is justified by the amount of observations the various situations allow. A more detailed discussion is given in the section, "Comments on the test" (following). In the original design of the Spatial Relations Performance Test only the first part of "cars" was utilized, hence, the scoring. Additions were made following the first complete run of the test, and they were based on direct observations, and comments made by the children which pointed to the possibilities offered by situations such as those outlined to clarify meanings and obtain a better understanding of difficulties and ambiguities Although desirable, no attempt was made to modify the numerical scoring of this test, in order to allow test-retest comparisons of total performance scores.

3. Shapes:

a. Material: Strip of mylar with drawing of: square, triangle, oval, circle, rectangle; wooden shapes: cube, cone, cylinder, pyramid.

b. Presentation and directions: Showing the child the first design on the mylar; "Can you tell me what this is?" all designs are shown then the cube is presented with the same question. If child answers: "A piece of wood" he is told: "Yes, that is what it is made of, but I want to know what shape it is." If needed this is repeated with each shape.

c. Scores: Total right. 1-differentiates solids.

4. Localization:

a. Material: 1 6 1/2 x 3/4 cardboard hollow cylinder; 2 1/2" kindergarten beads, one cylindrical and one spherical; half a box.

b. Presentation and directions: Presenting the cylinder: "what would you call this?" name given by the child is adopted. Presenting the beads: "You know what these are..yes, they are beads, and one is round, the other is a cylinder (or, a long one). Now we stand this pipe (or whatever the child has named the long cylinder) in this box like this, and you are going to drop the beads in it. Which one do you put in first?....where are the beads now?.....If we lift the pipe a little bit which one will come out first?..." do while child is checking. "Good, now let us do it again...you put in the beads...now I put my hand on top of this pipe, you hold it and we turn it upside down, like this...now, where are the beads?...and which one do you think will come out first from the bottom?"

c. Scores: right/wrong for each position. Wrong guess followed by correct explanation is scored right.

5. 2/3 Dimensions:

a. Material: 5 containers of obviously different shape and size. 5 matching solids, and 5 2-dimensional shapes matching the solids.

b. Presentation and directions: Three containers are presented one at a time: "here is a box....another box....and another box....Now let us put these boxes to a side while I show you some objects." The corresponding solids and shapes are presented, one by one, with no further comments. "Now, here

are your boxes again, remember. I want to see how fast you fill up the boxes. Put one object in each box, but make sure that the box is full. Do you understand? Ready?"

This test is not timed but the child is asked to work as fast as he can to avoid random trial of each object in each container and invite selection.

If only one of the boxes is properly filled and when failure to fill the others may be attributed to poor manipulative skills, the test is repeated with the other two containers.

c. Scores: If child has used correctly the 3d objects he gets a score of 2. If he has used the correct 2d shapes, a score of one. A score of 0 is given when the objects are placed at random or in the wrong position — indicating that the child has not realized the relationship between volumes and shapes.

d. Observations: Does the child orient and rotate the containers, the objects-- does he differentiate between horizontal and up-right. Does he attempt to measure volumes, areas? Does he have any plan of activity? Does he realize that he is not doing right? If he rotates objects, which hand does he use?

Squares:

a. Material: Fraction square game (No. 250, Arithmetic Tangibles) halves, fourths and eights.

b. Presentation and directions: 2 rectangles are used for demonstrations: "here are two pieces of rubber and they are alike. See, we can put them together like this and they make a bigger piece and a different shape. You do it now....good, what shape have we made?" It is easier to adopt name given by child than trying to call it a square.

Make sure you know how we did it and how big this is. Now we put this to a side for a while and I give you two other pieces of rubber and I want you to make a... square....just like the one we made together....here it is, feel it again. Ready now, here are the two pieces. "Give in succession the two triangles. "Tell me when you are ready".

After the first square is completed: "Here are four smaller pieces to make another square. They are all alike. Tell me when you are ready."

No. 3: presenting the 8 rectangles: "These are more pieces to make a square of the same size." If child makes a rectangle or piles up the pieces instructions are repeated: "I want you to make a square like the one we made together. Here it is, feel how large it is." (the first square is re-presented and the child's hand placed on it.) If he changes his pattern, but still makes a rectangle, he is asked: "Do they feel alike now?"

No. 4: "This time we have two small triangles to make a big one, like this one." The large triangle used for the first square is shown then left within reach. If child makes a square he is reminded: "You want to make a triangle this time.", or shown again the triangle. No further instruction is given.

No. 5: "I give you two other pieces, now you have four, and this time you make a square again."

No. 6: "This is the last one, do you want to try it?" The children are usually willing to try, but the small triangles (8) that make up this last square present some difficulty of manipulation and the task may prove to be too frustrating unless put on a voluntary basis. If the child shows to have a plan of work (either 4 small squares or two large triangles) but encounters difficulty in handling the material help is given.

c. Scores: Each item is scored right or wrong and time is recorded.

d. Observations: Which hand is used to explore shapes, hold pieces and build shape. Is the child aware of shape, size, perimeter, or surface? Does he rotate pieces when needed? Does he correct or disrupt patterns? Does he have idea of what he is trying to do? Does he plan his activity? Is he aware of errors made and variations occurring? Does he repeat the same error, especially on No. 5. Is there consistency of direction in building?

What amount of pressure does he use? In what direction, downwards or against the other hand? Attitude: Self-assured, apologetic, ingratiating, cooperative.

7. Blocks:

a. Material: 1--8½cm hollow cube, 4--8½ x 8½ x 2.1 cm blocks, 1--8½ x 8½ x 4.3 cm block, 2--8½ x 4.2 x 2.1 cm blocks; 1--8½ cm cube cut diagonally from the midline of one surface to the opposite corners with volumes in the ratio 1:2:1.

b. Presentation and directions: The hollow cube is presented. "Here is a big block. Do you know what shape it is? (accept name given). We put this here and I will give you other blocks to make one as big as this one....here they are. (The 8½ x 8½ x 4.3 and two of the 8½x8½x2.1 blocks are placed in front of the child). Make a block like the one I showed you. Tell me when you are ready." After the first block is completed the second set is presented: 3--8½x8½x2.1 cm blocks and 2-- 8½x4.2x2.1 cm blocks. Directions are repeated.
No. 3. The three wedges are presented: first the ½, then the two ¼s, each standing on the triangular side. This position was selected to emphasize the right angles of the smaller blocks, reduce possibility of chance success and the difficulty of manipulating slanting surfaces. With older children the first set is presented as consisting of the 4--8½x8½x2.1 cm blocks. Then the above description is followed.

c. Score: Each item is scored right or wrong and time is recorded.

d. Observations: Does the child appear to be concerned with volume, height, shape, size, is he aware of the relationship of parts to the whole? Is his approach analytic, synthetic?
Note: In this test, like in squares and in the Sticks and Discs (following) a record is kept of all the moves made (drawings).

8. Board:

a. Material: A rectangular wooden board (30x42 cms) framed by a continuous rim 1 cm high and 1 cm wide. The surface of the board is covered by a rubber mat permitting inpressions to be easily made in the Mylar sheet (plastic) which runs in a continuous roll under the rim and above the rubber mat from one end to the opposite end. In the center of one long side a window (1½" hole) is cut through the rim. On the opposite three sides a peg may be moved to various positions.

b. Presentation and instructions: (First position) Place board in front of the child with "window" side towards him. "Here is a board with a rim (edge....wall) around it and here, in the rim, there is a window.....feel it? I put this peg here and give you this pen. I want you to show me how you would go from here (the peg) to the window--make a line from the place marked by the peg to the window, just the way you would go, if you were walking. Now do it again with the other hand." This is the first position and the peg is placed directly across the board from the window. 2nd. position: With the child holding the sides of the board, the board is rotated 90 degrees to the right (left if child is left-handed): "You put your hands here, and we turn the board....like this. Now here is the pen again. Make a line from the peg to the window. Do it without touching the window..... try to remember where it is."

3rd. position: The peg is moved to the hole in the short side farthest from the child and directions are repeated. The child is allowed to locate peg and window.
4th. position: The peg is moved to the hole in the other short side of the board. Directions are repeated. If the child has consistently gone around the corners he is asked, "could you go from the peg to the window any other way?" and allowed to draw another line. Board is then rotated back to original position: "Now show me where the middle of this board is: make a dot as close as you can to the middle."

c. Scores: The following items are scored right/ wrong: maintains orientation after rotation, uses lines (vs scribbles) uses diagonals, measures center from 2 directions, measures centers from 4 directions. Uses one hand as point of reference. Pressure: Excessive or too little pressure is scored 0. good but uneven: 1; optimum 2.

d. Observations: Extent of spontaneous exploration of board, hand and direction of movement preferred. Consistency of approach.

9. Sticks and disks

a. Material: 2 metal boards, one approximately 80x50 cms, the other 26x20 cms 10 magnetized sticks in 3 lengths, 10 magnetized wooden disks 4 cms diameter.

b. Presentation and directions: The larger board is placed in front of the child "This is a metal board for you and here is another smaller board that I will use. With these boards we use sticks like this one. Here is another stick for you. With two sticks just like yours I make a design on my board. I want you to feel my design very carefully and then make one, just like mine, on your board. Here is my design......make one just like mine. Tell me when you are ready." The six designs are presented successively without further instruction. If the child rotates the first two designs and uses only one hand in feeling the pattern, he is invited to use both hands. If the child fails consistently in reproducing the designs, he should be given another chance with the board held upright, back towards him. The position of the large board remains the same.

c. Scores: Right/wrong in terms of reproduction of relationships, regardless of rotations of the design as a whole. Number of rotations is noted. A total time score represents the interval between presentation of the first design and completion of the last one.

d. Disks: Presentation and directions: This time instead of sticks we use disks. Like this one. This is my first design. Make sure you feel the whole board..... here are some disks for you. Tell me when you are ready." If the child asks to see the board again, after the second time he is warned that he will not be allowed to see the next design again after he starts working on it.

e. Scores: Same as for sticks. Reduction in size of design, or enlargment to cover the whole board are recorded.

f. Observations: Both these tests offer good opportunity to observe the touch of the child: grasping, sweeping, structuring, analytic, synthetic, and the awareness of relationships between the elements of the design and of the design as a whole to the board and to the child himself.

10. Vocabulary:

Directions: "Tell me and show me what these words mean: small.............." Mylar and all the objects used in the test are made available to the child. This test is tape recorded. For list of words see scoring sheet

Spacial Vocabulary Test

Name: ______ **Date:** ______ **Tape No:** ______ **Side:** ______ **from** ______ **to** ______

		Definition		Description						Type of response		
	Uses phrase	concrete	abstract	Position		Activity		Relatedness		Verbal	Motor	Locom
				Absolute	relative	Self	other	Intra	Inter			
Dimensions												
little												
big												
large												
high												
low												
long												
short												
tall												
shallow												
deep												
Internal relationships												
Edge												
corner												
surface												
side												
perpendicular												
curved												
narrow												
flat												
straight												
thick												
Shapes - 2D-3D												
circle												
oval												
square												
triangle												
oblong												
rectangle												
cone												
cylinder												
pyramid												
cube												
Location												
here												
there												
down												
up												
far												
near												
over												
under												
below												
bottom												

	Definition			Description						Type of response		
				Position		Activity		Relatedness				
	Uses phrase	concrete	abstract	absolute	relative	self	other	intra	inter	Verbal	Motor	Locom
Relationships of Position												
on top												
inside												
outside												
between												
around												
against												
middle (in)												
beyond												
above												
parallel												
Self Reference												
ahead												
before												
behind												
across												
in front												
in back												
beside												
opposite												
towards												
away												
Direction or position												
Right												
left												
my right												
my left												
north												
by												
past												
through												
straight												
front												
Static/Dynamic												
space												
shape												
form												
distance												
volume												
area												
width												
length												
depth												
height												

Comments on the test.

The test was developed in the course of a longitudinal study of the development of spatial perception in congenitally blind children, with andwithout light perception. The main purpose of the test was that of creating an opportunity for specific observation of performance at various age levels to obtain comparable data in terms of individual development and group averages. During the course of three years it was administered to a total of 132 children between 5 and 15 years of age. Approximately 100 of this total group were tested between two and four times. The source of many of the items included may be easily found in tests in common use in educational and clinical psychology, however, no attempt was made to duplicate testing situations or adapt scoring standards or criteria from other tests as it was not the purpose of this study to compare the performance of the blind with that of other groups of subjects.

A complete discussion of the test is beyond the scope of this report, however, the following comments are offered to justify the inclusion of the individual items and clarify the meaning of the related observations.

Object recognition: Aiming at testing recognition doll-house size replicas of furniture were selected on the assumption that they would be familiar to all children since it was known that this particular group of children had been exposed to these toys. This assumption proved unwarranted. The eight tables and nine chairs included varied in shape size, material and texture, to establish whether the child had or formed a concept, or was naming the objects at random. The remaining seven objects, each different, presented various degrees of perceptual complexity and more specifically aimed at testing the child's ability to investigate the object, analyze details and synthetize them into meaningful wholes. Approximately 12 per cent of the children in the present study recognized all the objects, while 20 per cent recognized none. In general younger children regarded them as toys, older ones as models, but in both instances correct naming of some of the items did not indicate a concept. The value of this item is to be found in the number and type of observations it makes possible with regard to tactual activity and perceptual processes.

Cars: This item was designed to test discrimination of size and shape and concept of relative position, to observe freedom and extent of movement and the ways in which the child structures space spontaneously in a "play" situation. Identification of relative position depends on the ability to objectify the situation, i.e. to detach oneself from it and accept an objective frame of reference. This occurs twice in "cars": the first time when the child is asked to recognize the front and back of the cars, and relate this to direction of movement, and the second time when he is asked to identify the position of cars with reference to the road. In the second instance he is asked to imagine a situation which he has actually not directly experienced but which is basic to orientation. The process of perceptual abstraction called for in this case is the same as that more concretely illustrated in the second position of the Board which requires memory rather than imagination. Both items clearly show the difference between perceptual abstraction and spatialization of motor sequence with regard to orientation for the latter results in recognition of direction and not of position. (vide Fig. 10, p. 51) . . The child who calls "front" of the car the side towards him, moves the cars frontward, backwards and sideways and is unable to imagine the road situation. Correct understanding of the structure of the car in relation to direction of movement is a necessary, but not sufficient condition for correct answer to the "road" for this requires viewing movement and direction as other than the experience the child has of it (motor and manipulative), and referred to a space of movement which if parallel to that of the child is nevertheless organized along vertical and horizontal axes other than those of the body. The idea of surface, or plane of the "road" is equivalent to that of topographical orientation as distinguished from self-orientation. Similarly, in the third position of the board, the use of the diagonal indicates the same understanding of surface, which is also operating in the correct localization of the middle of the board. The Board presents a more concrete problem than cars, and a more real situation: good performance on the board, and poor on Cars may indicate the possibility of distinguishing between concrete and abstract levels of spacial organization. Additional indications to this effect may be sought in the consistency of type of performance in squares and sticks-disks.

Shapes: Tests ability to recognize and name shapes, and to differentiate two-dimensional from three-dimensional objects. A separate score is given for differentiation of solids, regardless of correct naming as it was found that in many cases children had not been taught the names of solids (i.e., cube was called "square" or "square block".) In the vocabulary test the child is asked to define the same shapes and draw them, or select them: comparison of results of vocabulary and shapes is most interesting. Figs No. 3, 8 show designs of triangles and squares corresponding to definitions such as: Triangle: three points, two sides and a point; square: four sides; four corners. These responses are typical of children perceptually functioning at a temporal-motor level. Included are drawings of sticks designs done during the training program. These children failed to distinguish three-dimensional from two-dimensional shapes and in general to name most of the shapes. It is relevant to note that sweeping grasping, and in some cases even static grasping touch, may differentiate squares, triangles and circles but metric touch is necessary to distinguish rectangles from squares and ovals from rounds when differences are relatively small, and both hands are needed for the identification of solids. Sweeping touch, in examining a square or a triangle may easily result in "something flat and round", and in reproducing a square in a series of round scribbles.

Localization: This item owes its origin to Piaget and perhaps the type of explanations obtained would agree with his findings for a younger age. Blindness introduces a new variable that would have to be taken into account if results were to be compared: the blind child perceives the cylinder as having two holes, one at either end, rather than being hollow and on the first trial very often tries to retrieve the beads from the top. Failure on first trial and success on the second is a measure of learning that the hole goes through and applying this to the new situation represented by the turning of the cylinder. Failure on the second trial perhaps always indicates inability to localize the beads, regardless of results of first trial, unless the child himself understands and correctly explains the error. Although of the same size, tactually the sphere appears smaller than the cylinder thus introducing additional complications. Such as it is, this item is of little value and it was retained to establish whether or not localisation in this sense and within these limitations appeared with greater frequency with increasing age and for the appeal the test has for the children, younger and older.

2/3 Dimensions: This is a misnomer because the difference between the objects is one of thickness rather than dimensions. The name is justified by the fact that, unless drawings are used, the blind child only knows three-dimensional objects (cut-outs, coordination puzzles, etc.) differentiated into shapes and forms only by their thickness. In the selection of the material, the idea was of giving the child a choice of an object that would fill the box and a lid that would cover the box. For this purpose the size and shape of containers and objects were obviously varied. Correct performance implied selection of correct shape and of the solids, and error derived from selection of correct shape and of the solids, and error derived from selection of wrong shape and/or selection of lid. It is doubtful, however, that this item is actually tapping discrimination of shapes and forms in all cases as most of the children were very uncertain about the meaning of "full", although they never questioned it. When the E. became aware of this difficulty and asked the child to explain what "full" means, obtained the answer: "It means that there is something in it". At least 0 scores are questionable, and a score of 2 should be given not for correct selection onlv but for correct selection and placement of the solid in the container. Results on this item appear to correlate with differentiation of solids in "shapes" and with performance on "Blocks". Possibly the perceptual meaning of full is derived by the use of both hands, in opposition, or of both arms enclosing a space.

Fig. 9, to the right, shows the three blocks (1b,2,3) that constitute this test and (1a) the alternate that may be used with younger children. It also provides, for each of the blocks, illustrations of the most characteristic faulty approaches: 1A shows exclusive concern with surfaces, 2A and 3A with height, 1B, 2B and 3B with the shape of the top and 3C with volumes.

Fig. 10 provides a drawing of the board used and illustrates the various positions. In 3 diagonals are used, and in the two bottom drawings "corner" alternatives.

Fig. 9. Blocks

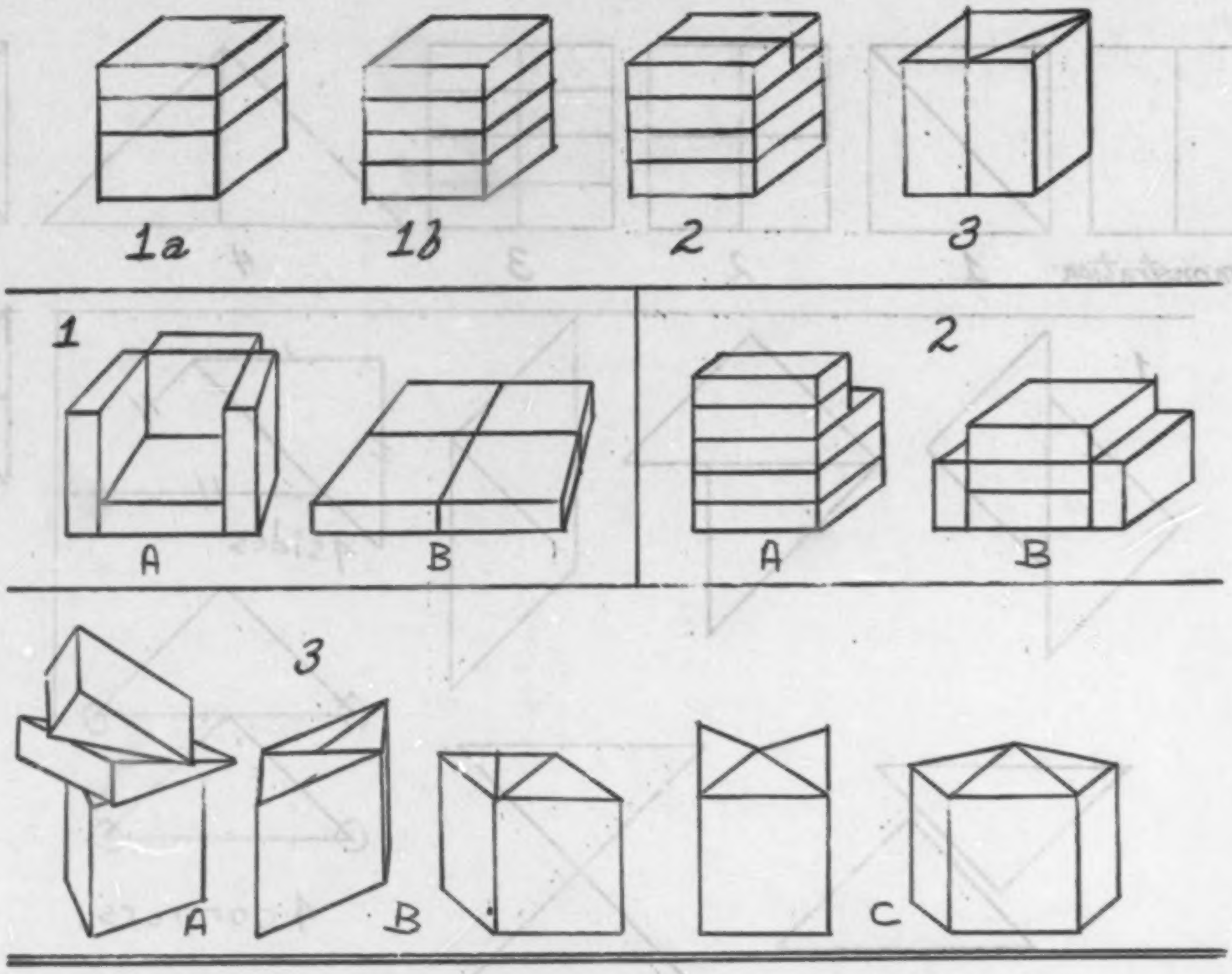

1a
1b
2
3
1
A
B
2
A
B
3
A
B
C

Fig. 10. Board

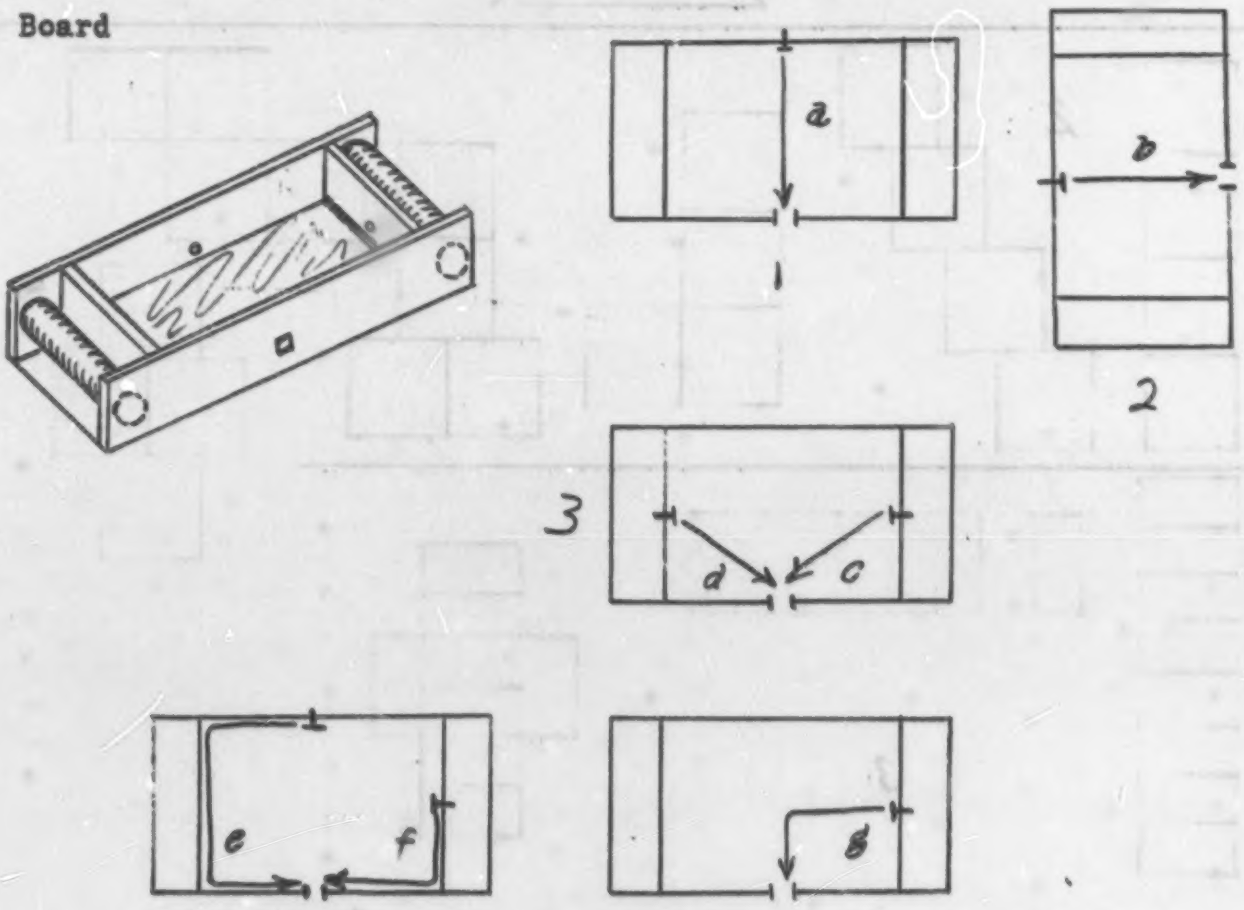
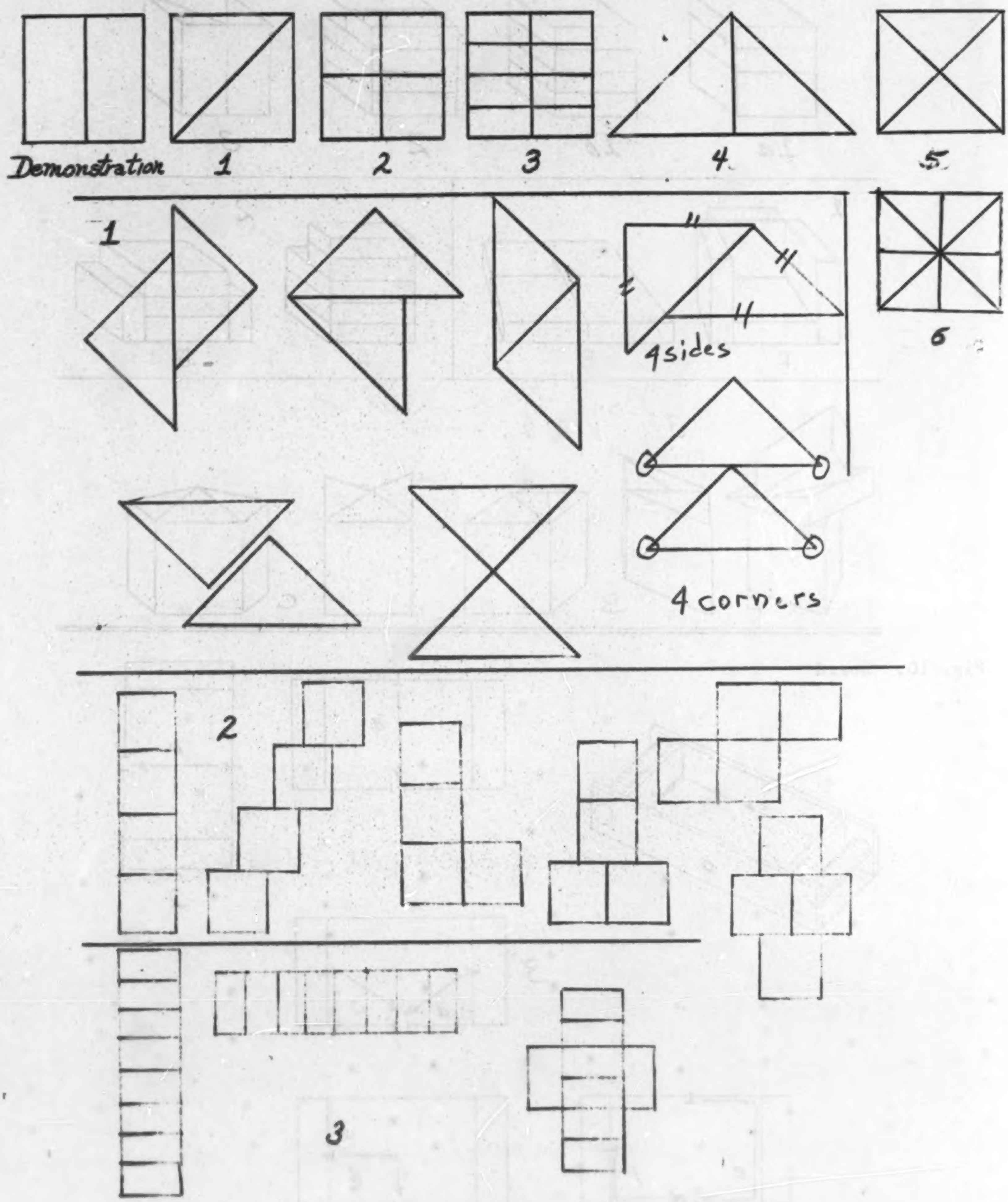
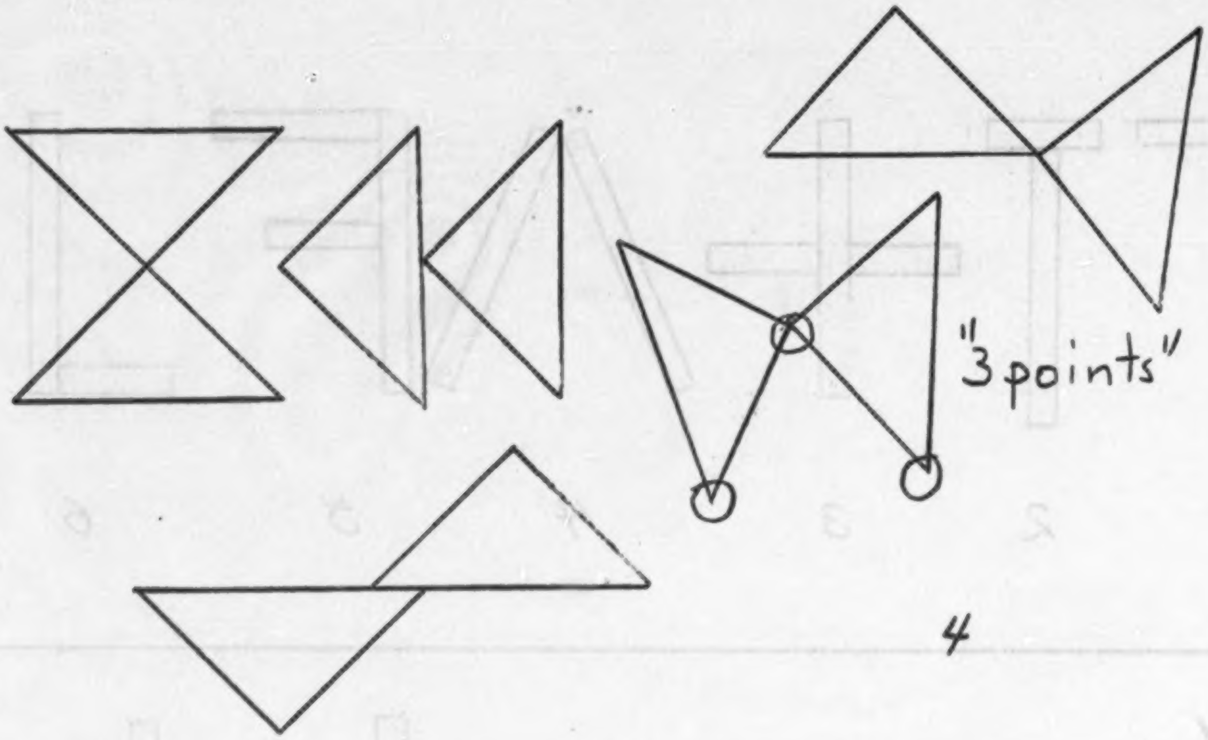
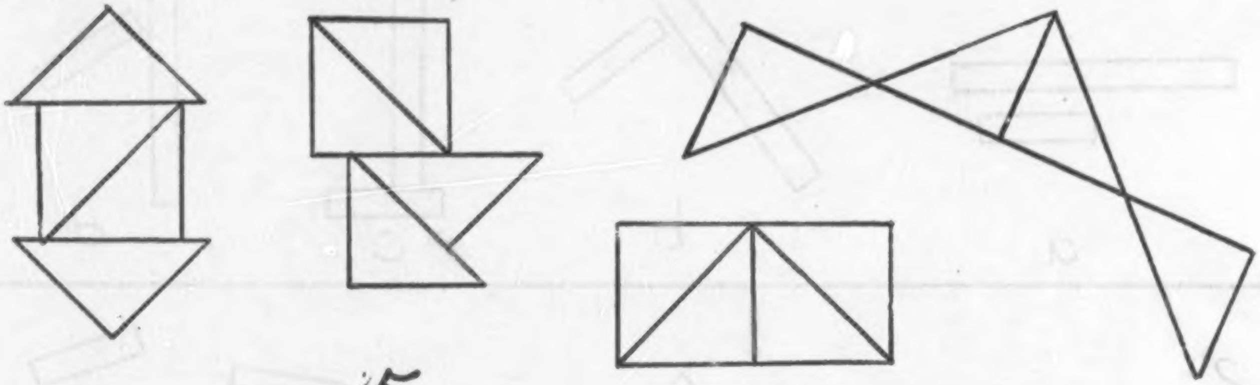

a
1
b
2
3
d
c
e
f
g

Fig. 11. Squares


Demonstration
1
2
3
4
5
1
4sides
6
4 corners
2
3



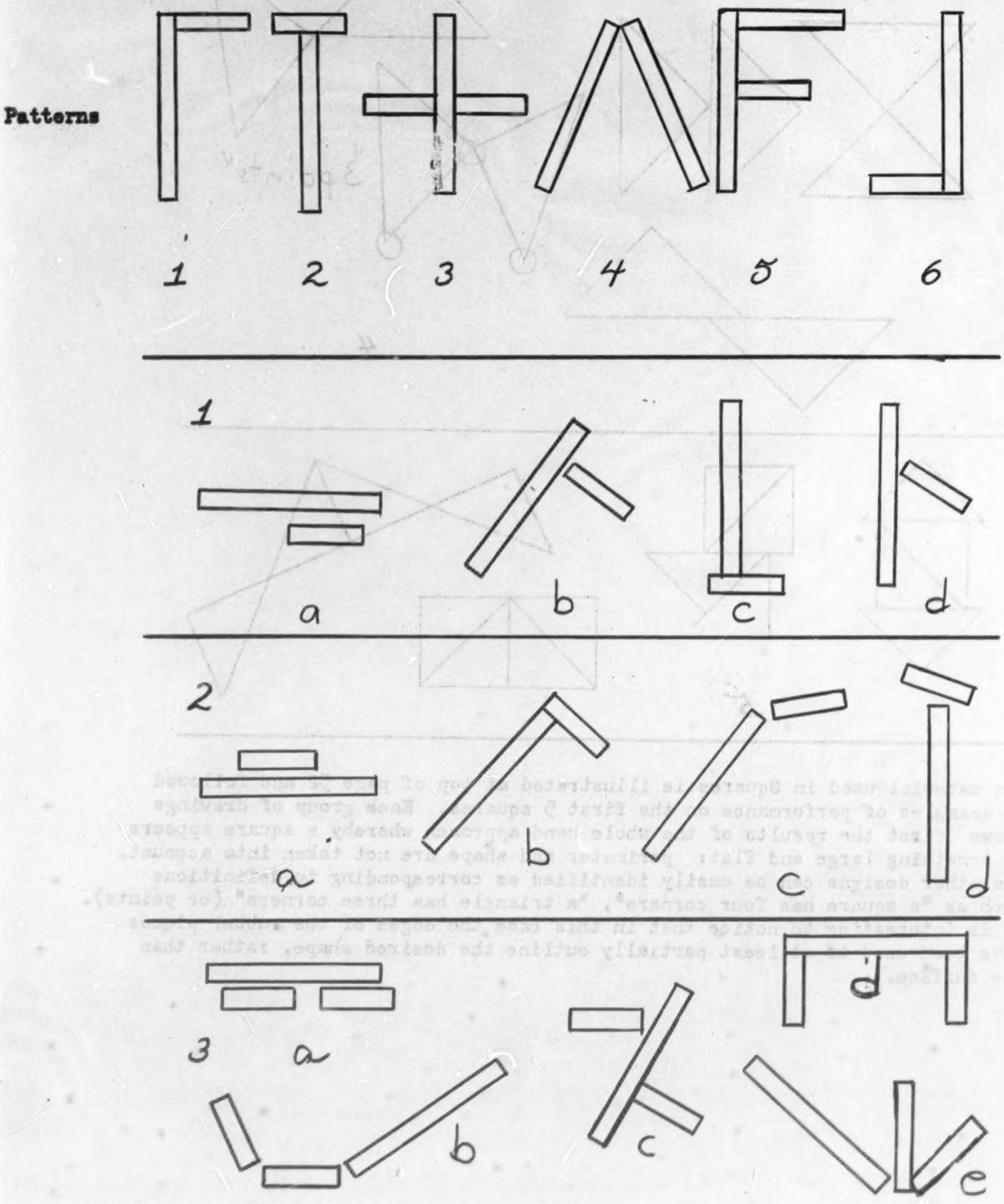
4

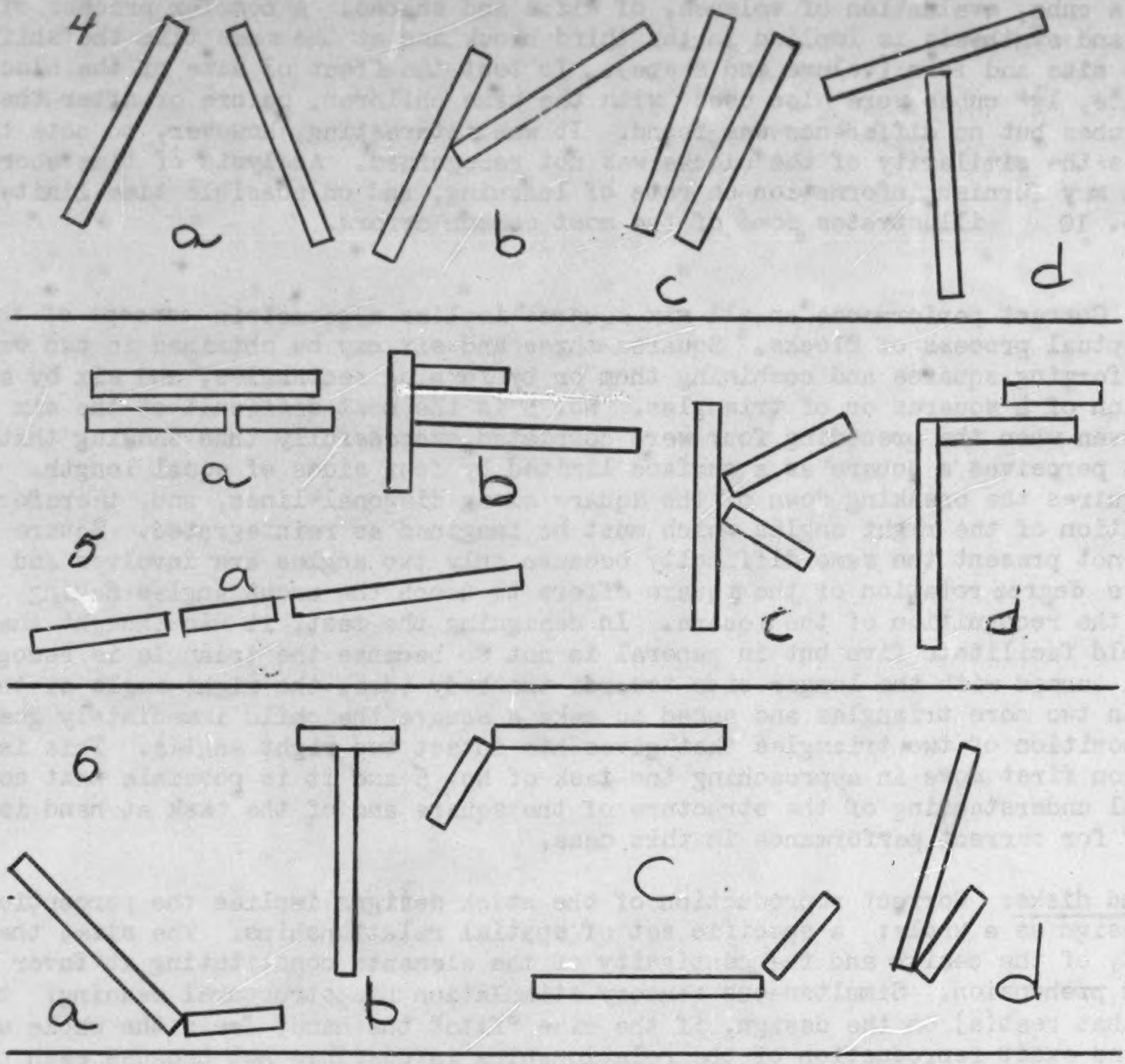


5

The material used in Squares is illustrated at top of page 52 and followed by esamples of performance on the first 5 squares. Each group of drawings shows first the results of the whole hand approach whereby a square appears as something large and flat: perimeter and shape are not taken into account. The other designs can be easily identified as corresponding to definitions such as "a square has four corners", "a triangle has three corners" (or points). It is interesting to notice that in this case the edges of the rubber pieces have been used to at least partially outline the desired shape, rather than the surface.

Fig. 12. Sticks


Patterns
1
2
3
4
5
6
1
a
b
c
d
2
a
b
c
d
3
a
b
c
d
e



All the "a" designs result from sweeping touch, with one hand, i.e. without any stable point of reference: the result is a temporal-motor series.

In the "b" designs the elements are distinguished by a vague awareness of changes in directionality. The one-hand motor approach is still evident in the lack of orientation of the designs.

In the "c" and "d" designs is possible to notice a progressive spatialization of motor activity. In 2,3, and 5 "d" especially changes in direction of movement are represented as relationships of position. The order of these relationships is a temporal one and the design is perceived as a spatial sequence: this implies sweeping-grasping touch and the use (inefficient) of both hands.

Blocks: The three blocks present increasing difficulty; and a progressive refinement of the concept of cube. Realization of the height of the block is sufficient for correct performance on the first one, the addition of shape is necessary for the second one, while the third one requires understanding of the relationships holding between parts of a cube, evaluation of volumes, of sizes and shapes. A complex process of analysis and synthesis is implied in the third block and at the same time the shift from height to size and form (volume and shape). To test the effect of size of the blocks on performance, 1½" cubes were also used, with the same children, before or after the regular cubes but no difference was found. It was interesting, however, to note that in most cases the similarity of the blocks was not recognized. Analysis of time scores in this test may furnish information on rate of learning, and on possible time limits. Figure No. 10 illustrates some of the most common errors.

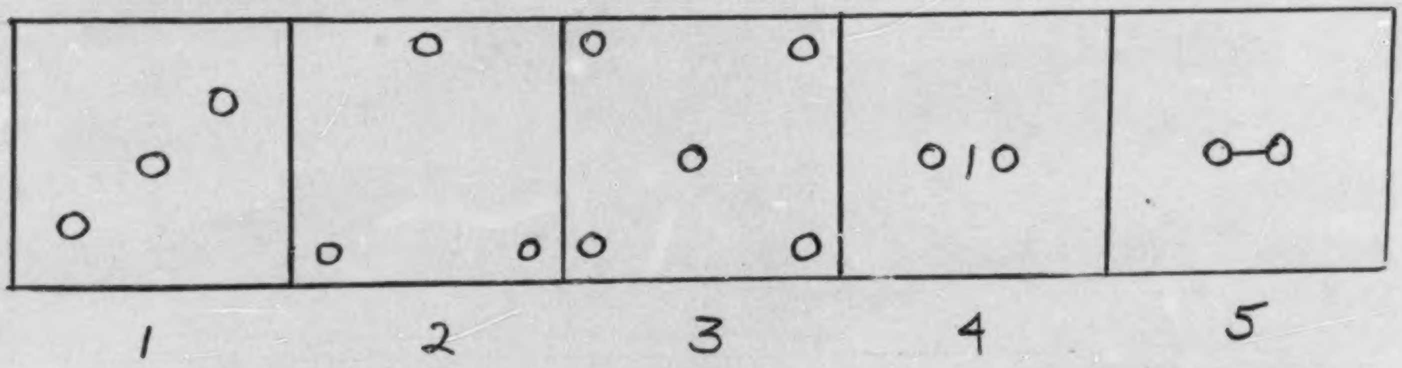
Squares: Correct performance on all six squares implies a geometric concept of the shape and the perceptual process of Blocks. Squares three and six may be obtained in two ways: three by forming squares and combining them or by forming rectangles, and six by a combination of 4 squares or of triangles. No. 5 is the most difficult of the six squares even when the preceding four were completed successfully thus showing that the child perceives a square as a surface limited by four sides of equal length. No. 5 requires the breaking down of the square along diagonal lines, and, therefore, the bisection of the right angles which must be imagined as reintegrated. Square one does not present the same difficulty because only two angles are involved and a forty-five degree rotation of the square offers to touch the uncut angles making possible the recognition of the square. In designing the test, it was thought that No. 4 would facilitate five but in general is not so because the triangle is recognized best when turned with the longer side towards the body (i.e. the right angle at the top). When given two more triangles and asked to make a square the child immediately goes back to that position of two triangles that gives him intact two right angles. This is the most common first move in approaching the task of No. 5 and it is possible that complete conceptual understanding of the structure of the square and of the task at hand is necessary for correct performance in this case.

Sticks and disks: Correct reproduction of the stick designs implies the perception of the design as a whole: a specific set of spatial relationships. The size, the continuity of the design and the contiguity of the elements constituting it favor a synthetic prehension. Simultaneous sensory stimulation has structural meaning: the hand(s) that rest(s) on the design, if the size "fits" the hand, feels the whole at a glance, and exact reproduction of the relationships is possible not because each part has been learned but because the whole has been learned: the parts will be arranged so as to reproduce the whole. The orientation of the design is not an intrinsic component of the pattern as such (outside quality), that is, its position against a tactually uniform background, is assumed as absolute, not relative to the body's vertical or horizontal. It stands to reason that it should be so because the hand that rests on a design against a parallel background perceives the background as an essential part of the pattern, like a shape is perceived at the same time as enclosed space and perimeter (visually) so that actually there is no physical plane to lend direction to the design, unless one hand touches the board without touching the design, therefore locating the design in a specific location of the board and determining its position with reference to the frame of the board and the observer's upright. Tactual perception of position and location requires the perception of the shift derived from subsequent prehensions with both hands in alternate positions: i.e., "relative position" of an object in relation to the body is derived from motor-postural shift correction, actual or imagined.

The disks do not constitute a design in the same sense as sticks, unless the size of distances, position, size of hand, etc. make possible a synthetic prehension. The disk pattern is basically motor-directional and must be learned as such, not, if not inferentially, as a spatial pattern. Spatially interpreted disk patterns are reproduced piece by piece, relative to the board, not as a disk pattern but as a series of individual disk-board relationships. When the pattern is seen as a motor sequence the location of each disk represents a particular arm-hand movement, directionality and distance being established with reference to the body (fulcrum). Also in this case, obviously, it is not a matter of design or spatial pattern; the pattern arises only when not the movements are considered, but the positions achieved at the end of each movement and each position is assumed as the reference for the next distance-direction activity so that each position is seen as contiguous to the preceding and the following one and related to all preceding and following ones. The continuity, clearness and integration of the perceptual patterns originated by disk designs are functions of the extent to which each position determines contiguous relationships and endures in non-contiguous (non-simultaneous) relationships and thus becomes more and more specifically defined as a location.

While the last two designs are passible of a synthetic prehension the first three illustrate what was said above. Error in the last two disk designs usually derives from the habit to count: two disks and one stick is a natural grouping that goes counter, in both cases, to the spatial arrangement. Incidentially, this error is perhaps related to that resulting in sticks when relationships are seen singularly: one across, one across, etc.

Fig. 13. Disk patterns



Spatial Vocabulary Test: This test consists of 80 words subdivided in groups of 10 under the following headings: Dimensions, internal relationships, two and three-dimensional shapes, location, relationships of position, self reference, direction or position, static/dynamic space. The child is asked to explain verbally and to show what the words mean. He is invited to use the drawing board and any of the objects used in the test or that might be available. His verbal responses are tape recorded and at the same time, as shown in the scoring sheet (pages 46-47 of this report) responses are scored in terms of type: verbal, motor, or locomotor, a written account is kept of activity, in terms of type of definition and/or of description used. Lack of time has so far prevented a quantitative analysis of results. This test was included in an effort to gain a better understanding of the nature and development of spatial concepts in congenitally blind children. Many of the observations made have been reported in the section on language and have informed the development of the training program.

Attack Score: Attack scores represent a summary of observations made on the method of attack of the specific tasks of the test and of the testing situation in general. In some cases additional observations were carried out to determine whether the attack during the test could be considered or not a typical method of the child. These observations included classroom situations and cottage or playground activity. The observation schedule on the following page was used as a guide. The results of these observations were compared with the annotations made on the performance of the various items of the test and summarized numerically under five cathegories: Relationships exploration, touch, perception and pressure, affording a score range of 0-18. Attack scores were interpreted to mean efficiency of performance, actual or potential.

Reliability of Scores: The reliability of the Spatial Relations Performance Test and the Attack scores were computed on the basis of a test-retest at a five month interval. The reliability of the Performance Test Scores was .94, of the Attack scores .81. The reliability of the scoring procedure was checked by scoring and rescoring the initial Performance Test at a three-month interval. A reliability coefficient of scoring of .89 was obtained.

Observation #___

Name___ Date___ Time: from___
Situation: ___ to ___

Mannerisms:

Sitting	Body	Head	Hands	Legs	Occasional	Continuous
Rythmic						
Arythmic						
Spastic						
bilateral						
unilateral						

Standing					Occasional	Continuous
Rocking						
Jumping						
Gyrating						
Shaking hands						
head						

Obstacle perc. ___
Balance ___
gd pr av

Locomotion: Fast___
Slow___
Fearful___
Veer rt___
lt___
Random___

Hands:	Palmar	dorsal
right		
left		
both		
either		
neither		

Search: hands	front	left	right	back	pat	sweep
right						
left						
both						
either						
Space: Ext.						
Limited						

Movements (exploring)

	Right	Left	both	either
Controlled				
Inhibited				
Exagerated				
Effective				
Effective				
far				
near				
Reaching				
arms:-				
extended				
flexed				

High___
Low___
eff.___
overreach ___
underreach___

Touch	
Static	
dynamic	
sweeping	
Grasping	
sweep/grasp	
metric	
selective	
structuring	
random	

Pass,synthetic recog form ___
Active analytic ___
" " shape___
" " shape & form___
aware relationships___
intentional anal.___
ana/synth. ___
which one identification
insight recognition___

Grasping: from top___ bottom___ twd self___ away___ thumb over___
under ___

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DATA GATHERED AND RESULTS

The following data were gathered with respect to each child in the experimental and control groups at two or more points in time as indicated below. The 1957 data were gathered as pre-test data in the fall of the year, while the 1958 and 1959 ones were gathered in late spring at the end of a phase of the training program. As reported earlier, the 1958 training program consisted of three half-hour sessions per week for a period of twelve weeks beginning in March 1958, whereas the 1958-59 training program continued throughout the school year at two hours per week.

	1957	1958	1959
Medical Report	x		x
Housemother Report	x		x
Self-care			
motor ability			
recreational			
Teacher Report	x		x
skill in braille			
spatial orientation			
mannerisms			
activity			
Observer's Ratings		x	x
Orientation to sound			
obstacle perception			
motor control			
posture			
veer			
use of hands			
blindisms			
Spatial Relations Performance Test	x	x	x
Observations			
Performance			
Spacial Vocabulary Test	x	x	x
Chronological Age	x	x	x
Mental Age (interim Hayes-Binet)	x	x	x
Intelligence Quotient	x	x	x
Stanford Achievement Test (Adaptation for Blind) (grades 3-7 only)	x	x	x

Correlational analysis and t tests for significance of differences in the means of experimental and control groups, as well as net differences between groups were made.

Table 1 provides a frequency distribution of chronological and mental ages of the control and experimental groups. The experimental group is somewhat younger and less able intellectually than the control group. In part this results from the greater homogeneity of mental age in the experimental group. The primary basis for selection was severity of handicap in the capacity to explore the environment and attack new tasks. No special attempt was made to match groups other than to ascertain that they were roughly comparable, in the sense that gross disparity in age and tested intelligence was not present.

Table 1. Chronological and Mental Ages of Control and Experimental Groups

Age Level	Control Group		Experimental Group	
	Chronological age	Mental age	Chronological age	Mental age
16.0-up		2		
15.0-15.9		3		1
14.0-14.9		2		1
13.0-13.9	3	1	2	
12.0-12.9	6	2	4	1
11.0-11.9	5	3	3	1
10.0-10.9	2	4	1	2
9.0-9.9	2	1	4	4
8.0-8.9	4	2	4	4
7.0-7.9	2	3	5	5
6.0-6.9	1	1	2	4
5.0-5.9	2	2	1	2
4.0-4.9		1		
N	27	27	26	26
Median	11.0	11.4	9.3	8.9

Subsequent Intelligence Tests routinely administered as part of the school testing program reveal equivalent growth in mental ages for both groups with mean Intelligence Quotients for the groups remaining nearly identical with that obtained in original test. Achievement test gains were comparable for both groups and were related to the elapsed period of schooling. No correlation was observed between gains on the Spatial Relations Performance Test and scholastic achievement.

Four sets of data were available for appraising the effectiveness of the training program designed to develop skill in ability to explore the environment and attack problems and the gains or changes in spatial orientation. Gains in exploratory skill in the control and experimental groups could be compared and these differences related to scores on the Spatial Relations Performance Test and to ratings by teacher, cottage housemother, and an observer. With the exception of the observer's ratings these data are shown in tables 2 and 3. The observer's ratings are not reported because none of the changes were statistically significant, in fact the changes noted were negligible. Observations were made of walking and running skills, maintenance of body position, orientation to sound, obstacle perception, posture, use of hands in grasping, reaching, holding, and of blindisims such as rocking, gyrating, jumping, swinging hands or arms. Three conditions affected the usefulness of these ratings and their reliability: The proximity of the two ratings (December-May), variation in location (shop, craft room, cottage, playground, gymnasium, swimming pool) and the variability inherent in observations made in naturalistic setting. To expand on these difficulties: orientation to sound presents greater difficulties to blind children out-of-doors than inside, in a familiar setting, walking and running vary in relationship to the activity in which the child is engaged, blindisms occur with different frequency at different times and in relationship to the immediate activity and the degree of tension being experienced, and ratings on use of hands in grasping

Table 2. Pre- and Post-test Scores of Control and Experimental Groups.

Measure (range of scores possible)	Control						Experimental					
	Pre-Test			Post-Test			Pre-Test			Post-Test		
	Mean	S.D.	S.E.$_M$	Mean	S.D.	S.E.$_M$	Mean	S.D.	S.E.$_M$	Mean	S.D.	S.E.$_M$
2.1 Attack (0-18)	12.37	4.9	.9	14.3	4.8	.9	5.0	2.7	.5	9.8	4.5	.85
2.2 Spatial Relations Performance Test (0-60)	42.7	18.5	.4	46.7	17.2	.33	16.5	10.0	2.0	31.1	13.7	2.7
2.3 Housemother Performance (0-17)	10.9	5.0	1.2	13.1	3.8	.9	6.6	4.2	.9	10.9	4.9	1.0
2.4 Housemother Orientation (0-4)	3.4	1.1	.3	3.2	1.3	.3	2.2	1.5	.3	2.1	1.5	.3
2.5 Teacher Orientation (0-5)	4.0	1.1	.25	3.2	1.0	.23	2.4	1.3	.26	3.0	1.1	.23
2.6 Braille (0-5)	3.5	1.5	.4	3.4	1.2	.3	3.3	1.1	.27	2.9	1.0	.26

Table 3. Differences between Pre- and Post-Tests of Control and Experimental Groups and Net Difference between Groups.

Measure	Control				Experimental				Difference	
	Mean Diff	S.D.$_D$	S.E.$_D$	t	Mean Diff	S.D.$_D$	S.E.$_D$	t	Net Diff	t
3.1 Attack	1.9	4.2	.8	N.S.	4.7	3.0	.58	.001	2.8	.01
3.2 Spatial Relations Performance Test	4	10.2	2	N.S.	14.5	8.8	1.7	.001	4	.001
3.3 Housemother Performance	2.2	4.7	1.1	N.S.	4.3	4.5	.9	.001	2.2	N.S.
3.4 Housemother Orientation	.2			N.S.	.1			N.S.	.1	N.S.
3.5 Teacher Orientation	-.8	1.2	.26	.01	.7	.9	.2	.001	1.5	.001
3.6 Braille	-.1			N.S.	-.4			N.S.	-.3	N.S.

or holding will vary according to the object, e.g. basketball or pencil. In short, we learned that for such ratings to be useful as a minimum a child should be observed in the performance of comparable tasks rather than what chanced on a given day of observation and preferably some degree of standardization of task is desirable.

The significant findings of the study are shown in Tables 2 and 3 and Figure 14. The control group shows no changes of sufficient magnitude to be statistically significant with the exception of the teacher's rating for orientation (3.5) which is significant at the .01 level of confidence. The gain in attack scores (skill in approaching, exploring, and undertaking a manipulative task) approaches the .05 level of confidence. In comparison the experimental group shows changes which are statistically significant at the .001 level of confidence on four of the six measures (3.1, 3.2, 3.3, 3.5). The gains in attack indicate that the training program had positive effects, which is corroborated by the housemother's rating of performance. These effects had positive transfer effects on the experimental group's performance on the Spatial Relations Test and on their orientation in the classroom situation as judged by teachers' ratings. The net differences between the control and experimental groups are statistically significant on three of the four measures (3.1, 3.2, 3.5). A further corroboration of the findings is shown in Figure 14 in which changes in attack scores in both control and experimental groups are correlated with changes in performance scores on the Spatial Relations Performance Test. In both groups, separately and combined the relationship between gains is positive and statistically significant. The correlation coefficient approximates .65 in the combined groups.

It may be argued that in any comparison in which one group is trained and a second left untrained, changes in the experimental group are to be expected, and if they are statistically significant it is the result of comparing a program with no program, rather than two different kinds of programs designed to attain similar goals. In this study, both groups were participating in a well-planned and carefully conducted full time educational program for the blind. The time allocation for the special training program attempted in this study was a small fraction of the total educational experience of the child. In this context it is significant to demonstrate that the spatial perception of the blind, if it is to get beyond the motor-temporal to the conceptual stage, requires special training in environmental exploration and discrimination of relevant stimuli.

The negative argument in this study rests with the difficulties inherent in effecting the change and the limited degree of change. At the end of the study, the experimental group had yet to attain the original level of the control group in both attack and spatial scores. We suspect, judging from the scores obtained by some six year olds, that the critical stages for such training experiences may be in the pre-school years.

		Control Group		Experimental Group		Combined Groups	
		Attack Scores		Attack Scores		Attack Scores	
		Loss or Gain < 4	Gain of > 4	Loss or Gain < 4	Gain of > 4	Loss or Gain < 4	Gain of > 4
Spatial Relations Performance Test	Gain > 11	4	13	1	5	5	18
	Loss or Gain < 10	7	2	18	3	25	5
		N 27		N 26		N 53	
		$\chi^2 = 10.6$ $> .01$		$\chi^2 = 7.4$ $> .01$		$\chi^2 = 20$ $> .01$	

Figure 14. Relations of gains and losses on attack scores to improvement on Spatial Relations Test in Control, Experimental, and Combined Groups.

SUMMARY

Direct observation and objective test data show that about 50% of congenitally totally blind children, regardless of age or intelligence have difficulty in understanding and applying spatial concepts, resulting in poor orientation, lack of manipulative skills, and limited interest in the environment. The basic purpose of this study was to determine if a training program designed to develop a more effective approach to the environment and response to relevant stimuli would result in improvement in the topographical orientation and spatial organization of blind children.

Sixty congenitally, totally blind children between the ages of 5 and 14 were given a Spatial Relations Performance Test (Garry-Ascarelli). Cottage supervisors' and teachers' ratings on the orientation and space perception of these children were obtained. On the basis of these ratings and test scores the total group was divided in two groups of "good" performers and "poor" performers. The poor performer group was divided in five groups and training was initiated with that phase of the program that seemed best suited to meet the specific common difficulty of the group. Each group received 2-2½ hours training per week during the spring of 1958 and the school year 1958-59. Three of the original training group left school during this period. At the end of each school year post-tests were administered to each group and new ratings obtained from cottage supervisors and teachers.

The following aspects of space organization were selected as phases of the training program: awareness of postural changes, concept and manipulation of extended surfaces, object perception and language. Phase one was specifically concerned with teaching ways in which posture and body movements help in determining position of self and establish a point of reference for the location of other places. Phase two centered on direction of movement and locomotion; location and direction in relation to distance, position and shape, the relation of temporal-motor and spatial sequences and the formation of spatial patterns. Phase three concentrated on the modality of touch, the spatial concepts and intentionality towards abstractive synthetic reductions necessary to the formation of spatial representations of form and structure. The fourth phase was concerned with how spatial relationships may be expressed symbolically, especially through language.

Statistically significant gains (.001 level of confidence) were obtained by the experimental group in attack scores (skill in approaching, exploring, and undertaking a manipulative task), in scores on the Spatial Relations Performance Test, and in two of four ratings by cottage supervisors and teachers. The control group (non-trained) showed a statistically significant gain (.01 level of confidence) in one of the five measures obtained, that of teacher rating for orientation. The correlation between improvement in attack score and gain on the Spatial Relations Test ranged from .50-.65 for each group separately and both groups combined. In spite of the fact that the experimental group showed statistically significant gains, and that the gains were significantly greater for this group than for the control group on attack scores, Spatial Relations Performance Test, and teacher rating of spatial orientation, the level attained by the experimental group at the time the training program was terminated was not yet equal to the original level of the control group, i.e. the "good" performer group.

On the basis of the data presented it was concluded that a training program designed to develop a more effective approach to the environment and response to relevant stimuli showed positive effects on the topographical orientation and spatial organization of this group of congenitally, totally blind children, and that it is possible through group training to direct or change the direction of the development of spatial perceptual patterns.

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